AN INVESTIGATION INTO THE INFLUENCE OF TRUST ON THE SHARING OF PRACTICAL KNOWLEDGE IN TECHNOLOGY PRODUCING SMALL TO MEDIUM ENTERPRISES (SMES).

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ABSTRACT

This study that uses ethnographic research methods explores how trust influences the sharing of practical knowledge in technology producing SMEs. More specifically, this project investigates how trust behaviours influence the sharing of various types of tacit and explicit practical knowledge. Currently, practice theory research recommends how practical knowledge can be shared however, efforts to share practical knowledge generally fail due to trust not been developed adequately in the collaborative relationships formed by companies. This research aims to inform practice theory of how SMEs can develop collaborative relationships more effectively. To succeed, these companies are particularly dependent on collaborative working as a source for growth and competitive advantage.

This investigation uses a qualitative research methodology, which employs a multiple case study approach where semi-structured interviews have been conducted with six engineers, three of whom work in large companies and three in SMEs. Observations were also conducted for one case study. These participants work at various levels and the companies themselves are based in a variety of geographic locations across the UK.

Based on the use of a thematic analysis on the interview data it was possible to characterise a practical knowledge sharing culture. In addition, the research outlines the specific perceptions and experiences of participants who adopted trust based strategies for sharing practical knowledge over the life of a project.

By applying a method devised in this research called narrative mapping, it was possible to identify patterns between trust behaviours and types of practical knowledge shared from participants' anecdotes. As the interviewees' anecdotes relate to specific relationship phases over a project life cycle, the research was able to build up a picture of how trust develops over the life stages of a project.

The findings provide a novel way of helping SMEs to develop effective collaborative relationships and associated working practices and inform future trust and practice theory research.

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ACKNOWLEDGEMENTS

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Final thanks go to my partner Judith, whose support has been essential in enabling me to get through and complete this work.

DECLARATION

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that the work fully acknowledges opinions, ides and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought, and was granted through the Faculty Ethics Committee on the 20th October 2015.

I declare that the Word Count of this Thesis is 85,990 words.

Name: Neil Parkin

Signature:

Date:

GLOSSARY OF TERMS

Definitions of key terms used in the text:

Characteristic Trust Antecedent:	Perceived behaviour(s) of the trustee that influence the trustor's intension(s) to trust that are found to be characteristic.
Dyad:	A social group composed of two members (Miller 2009)
Practical Knowledge:	Knowledge related to a set of actions and associated behaviours undertaken by one or more persons, in order to achieve an outcome with, or without the use of artefacts (Guzman 2009).
Trust based Practical Knowledge Sharing:	A dynamic process where explicit and tacit knowledge associated with what and how actions are shared between two individuals; a trustor and trustee and the associated trustworthiness intentions associated with it.
Small to Medium Enterprise:	A company that has 250 or less personnel (EC 2015).
Trust:	The willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor irrespective of the ability to monitor or control that other party (Mayer, Davis and Schoorman 1995).
Uncharacteristic Trust Antecedent:	Perceived behaviour(s) of the trustee that influence the trustor's intension(s) to trust that are found to be uncharacteristic.

Abbreviations used in the text:

5s	Sort (Seiri), Set in order (Seiton), Shine (Seisŏ), Standardise (Seiketsu) and Sustain (Shitsuke)
B2B	Business to business
ICT	Information Communications Technology
IJV	International Joint Venture
IP	Intellectual Property
JV	Joint Ventures
KM	Knowledge Management
NCFE	National Advisory Council for Further Education
NPD	New Product Development
OEM	Original Equipment Manufacturer
R&D	Research and Development
SECI	Socialisation, Externalisation Combination Internalisation (Nonaka 1991)
SME	Small to Medium Enterprise
SPC	Statistical Process Control

Anonymised Case Study Data:

Case Study One (CS1):

Company A

Alan

Company E

Co A Production Manager

Co A Production Engineer1

Owner of Company B

Company B

Co A Production Engineer2

Car Model A

Car Model B

Car Model C

OEM Company C

OEM Company D

Car Model D

Car Model E

Company F

Company G

Co A Production Engineer3

Co A Production Engineer4

Company H

Co A PLC Engineer

Company N1

Car Model F

Company A Managing Director (MD)

Co A Product A

Case Study Two (CS2):

Brian

Company I

Company J

Research Centre A

Company K

Company L

Company M

Company N

Co I Commercial Director

Co I Drawing Office Manager

Co I Design Engineer A

Company O

Lecturer A

Lecturer B

Co I Design Engineer B

Company P

Company Q
Company R
Co O Product A
Co O Group 1
Co O Group 2
Co O Product B
Co O Product C
Co O Product D
Co O Product E
Co O Product F
Company S
Advisory Service A
Company T
Company U
Company V
Company W
Company X
Company Y
Company Z
Company O CEO
Collaboration Model (Company O)
Company L2
Company M2
Company M2 Managing Director (MD)
Company O2
Company P2
Company Q2
Company R2
Company L Product A
Company L Product B
Company V2
Company W2

Case Study 3 (CS3):

Colin

Government Department A

Company A1

Lecturer C

Company B1

Technical Director Company B1

Company C1

Company D1

Industry Council A

US Government Department A

Company E1

Company F1

Company G1

Company H1

Company I1

Inventor 1

Company J1

Company K1

Company L1

Company C1 Engineer A

Company M1

Case Study 4 (CS4):

Derek

OEM Company C (From CS1)

Company O1

Company P1

Company Q1

Company R1

Company S1

Company T1

Company U1
Company V1
Company W1
Co O1 Product A
Company X1
Government Department E
Company Y1
Company Z1
Company A2
Government Department E Information System
Company U (from CS2)
Company S2
Government Department B
Government Department C
Government Department D
Improvement Programme A.
Company T2
Company V1 Product A
Company U2
Government Agency A
Government Cluster A

Case Study Five (CS5):

Elaine
Company B2
Company C2
Company D2
Company E2
Company E2 CEO
Software Product A
Software Vendor A
Software Product B

Company F2

Co B2 Product A

Software Vendor B

Case Study Six (CS6):

Frank

Company G2

Company G2 Group

Company H2

Company H2 Group

Company G2 General Manager

Company I2

Company J2

Company K2

Company L2

Company G2 Product A

Note:

Where appropriate the term ‘Company’ may be abbreviated as ‘Co’.

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

For many years organisations have undertaken various working practices to increase their competitiveness and improve their performance. Major initiatives undertaken include the adoption of continuous improvement programmes (Imai 2012), knowledge management systems (Hansen, Nohria and Tierney 1999) and more recently open innovation (Chesbrough 2003). The core of all such initiatives is the importance of knowledge, which has been recognised in numerous fields as being the main driving factor in an organisation's competitiveness. Grant (1996) for example has outlined that knowledge is the most important competitive asset that is possessed by a company. Seubert, Balaji and Makhija (2001) outline that sustainable competitive advantage is rooted in the effective channelling of intellectual capital.

As companies have implemented various initiatives to improve their performance and realise the value of managing their knowledge, efforts have turned to how knowledge is shared. As a consequence over the last 10 years, research in a number of fields has focused specifically on knowledge sharing. For example, Cabrera and Cabrera (2005) identify the people management practices that most effectively foster knowledge sharing. In addition, research conducted by Arthur and Huntley (2005) have also shown how knowledge sharing increases firm performance by reducing production costs.

While most of the aforementioned initiatives were initially implemented by the large companies, over the last 10 years there has been a growing interest from SMEs to implement similar improvement programmes. This has been confirmed by Staplehurst and Ragsdell (2010) who have observed growing evidence in UK SMEs adopting knowledge sharing strategies to become more competitive.

The importance of SMEs has been observed where for example Nesta Sage (2017) has reported a steady growth in SMEs in the UK since 2000, notwithstanding the impact of the financial crisis of 2008. More recently the UK government has reported that SMEs are a dominant source of economic growth and account for approximately 99% of the total population of companies in the UK (Rhodes 2018).

In this research, an Small to Medium Enterprise (SME) is a company that has 1 to 250 personnel (EC 2015) and a large company is taken as having 251 or more personnel (EC 2015).

1.2 PRACTICE THEORY

Researchers have generally considered knowledge as being in an objective (reductive) format and related to social action or practice (Crane 2013). Practice based theories appear to sit under these same groupings. Cook and Brown (1999) for example have considered knowledge as being possessed by an individual which can be acquired and shared. Blackler (1995) on the other hand characterises knowledge as a dynamic process of knowing which is situated and therefore based on practice.

Given that this research will consider knowledge has been dynamic and negotiated through social interaction, it will adopt a practice based view of knowledge, where such knowledge will be considered to be embedded or possessed in both "*individuals*" as observed by Cook and Brown (1999) and "*practice"* as proposed by Blackler (1995). Taking inspiration from Guzman (2009), practical knowledge in this research will therefore be defined as *"knowledge related to a set of actions and associated behaviours undertaken by one or more persons in order to achieve an outcome with or without the use of artefacts",* where knowledge is possessed or embedded in both individuals and the practices that are undertaken.

1.3 TRUST AND SHARING OF PRACTICAL KNOWLEDGE

Practice theory has been developed in a vast number of fields, which include philosophy (Bordieu 1990), economics (Dosi, Nelson and Winter 2002), Sociology (Giddens 1982), management (Leonard and Swap 2005), engineering (Pahl and Beitz 1988) and learning (Argyris and Schön 1974). Given that practice theory has been developed in such a broad range of fields may explain the differences in philosophical position as noted previously. Tunsi, Guzman and Shacklock (2012) however have developed a practical knowledge sharing framework which provides some insight into how such a theory can be developed. The aforementioned research does not however consider the role of trust.

Trust is widely acknowledged by scholars as being an important prerequisite for knowledge sharing. For example, when developing a knowledge sharing model Ipe (2003) outlines that trust is an important factor as it facilitates decisions that are made to exchange knowledge. Similarly, in the field of practice theory, trust has also been acknowledged as being important by Orlikowski (2002) who has commented that socialisation processes build trust, credibility and respect, all of which facilitate the sharing of practical knowledge. Despite the important role of trust in facilitating the sharing of practical knowledge as indicated, this factor has not been the focus of academic research.

Trust has also being important in facilitating the development of collaborative relationships. For example, Tömroos (2002) and Möller, Rajala and Svahn (2005) have both observed how SMEs have used their specialist skills to develop trust based relationships with foreign customer organisations thereby providing growth opportunities for the respective companies.

Trust based practical knowledge sharing is defined in this research as *"a dynamic process where explicit and tacit knowledge associated with what and how actions are shared between two individuals; a trustor and trustee and the associated trustworthiness intentions associated with it".* The knowledge sharer is regarded as the trustor as it is considered that the act of sharing practical knowledge

makes the individual vulnerable to the other individual, the trustee who is in receipt of the knowledge. The rationale for this position being that the trustee may use the knowledge in a way that the trustor may not agree with.

When practical knowledge is shared between the two individuals it is acknowledged that such knowledge may be modified or inspire the creation of new knowledge (Inkpen 1996). As a consequence, both the development of trust and sharing of practical knowledge may involve one or a number of forms of learning as noted by Eraut (2004a). It should also be noted that four types of practical knowledge, similar to those within the practical knowledge taxonomy developed by Guzman (2009) are utilised. The way in which the four forms of practical knowledge have been adapted for this research are outlined in Chapter three of this thesis.

The sharing of practical knowledge is taken from a practice based perspective and therefore viewed as a dynamic process facilitated by social interaction that is emergent, relational, place and time dependent, embodied, provisional, contestable and mediated through discursive exchange (Blackler 1995 and Nicolini 2011).

The trust based practical knowledge sharing approach as developed in this research is based on the integrated trust model originally developed by Mayer, Davis and Schoorman (1995) where trust is defined as *"the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor irrespective of the ability to monitor or control that other party"* (Mayer, Davis and Schoorman 1995).

In taking a practice based view of knowledge, this research takes inspiration from the integrative practice perspective as formulated by Jarzabkowski et al. (2016) who propose an integrative model of strategy practice. This perspective considers the context within which practices take place, who engages them and how working practices are undertaken. In taking such an approach,

Jarzabkowski et al. (2016) emphasise practice based outcomes are dependent on the interaction of the, who, what and how of practices.

1.4 OVERVIEW OF RESEARCH

A multiple case study approach has been undertaken that has allowed the researcher to examine how trust develops in the collaborative working practices of large companies and SMEs. It should be noted that all participants work in companies based in various geographic locations around the UK. The experiences of participants have also been collated and analysed in terms of anecdotes which are regarded as the unit of analysis for this research. The research primarily focussed on the working practices of SMEs, however participants who worked in large companies were also considered as a comparison. The sample therefore was composed of participants who worked in large companies and SMEs and divided up into two sub-groups.

Based on the research undertaken, a trust based practical knowledge sharing framework and narrative mapping method are proposed that can be used by researchers and engineering practitioners to analyse how trust and practical knowledge sharing data interact in specific project development activities. It is proposed that such data once collated for a number of projects would prove useful when looking to develop collaborative relationships on high value or high risk projects.

In applying the narrative mapping method, this research has been able to identify patterns of trust and associated practical knowledge shared for specific collaborative relationship phases for large companies and SMEs. As a result, this investigation extends researchers' understanding of trust development from a practice based perspective and informs both the trust and practice theory literature areas through the introduction of the narrative mapping method and trust based practical knowledge sharing framework.

1.5 RESEARCH AIM AND RESEARCH QUESTIONS

The primary aim of this research is to establish *"how trust influences the sharing of practical knowledge in technology producing SMEs".*

Using a case study approach, this research investigates the broader cultural factors that influence trust behaviours in SMEs and large companies.

Collaborative relationships are used as a mechanism for studying trust and the sharing of practical knowledge. Research is undertaken that compares and contrasts the experiences of engineering practitioners of collaborative working in key activities over the life of a project. After doing so, a more detailed treatment of experiences is undertaken that enables the researcher to analyse how trust behaviours develop while sharing various types of practical knowledge. Therefore the following three complimentary research questions are outlined:

1 What are the main characteristics of a trust based practical knowledge sharing culture within the sample of SMEs and large companies?
2 What are the specific perceptions and experiences of engineering practitioners who adopt trust based strategies for sharing practical knowledge for each collaboration relationship phase?
3 What are the specific perceptions and experiences of engineering practitioners that demonstrate how trust is constructed and how this influences the way practical knowledge is shared for each collaborative relationship phase?

For research questions two and three, the following collaborative relative phases and activities are considered:

- Relationship Formation:
  Partner identification, selection and initial trust building
- Relationship Implementation:
  Contract negotiation and development
- Relationship Evolution:

Informal learning

- Relationship Conclusion:
  Collection Reflection

1.6 LAY-OUT OF THESIS

Chapter One:

This chapter provides the background to the investigation, rationale for the research and overview of the research design. The importance of the study from both a theoretical and practical perspective is also outlined. The chapter concludes with a presentation of the research aim and questions.

Chapter Two:

The literature review considers the main literature areas of trust, knowledge sharing and collaborative relationships and establishes what research has been undertaken.

First of all, this chapter establishes how trust as a concept has been understood through its classification and measurement. Knowledge sharing is then considered from four perspectives; general influential factors, practice-based theory and tacit knowledge. When considering each perspective, implications are contrasted from both a large company and SME viewpoint.

Trust development in collaborative relationships within and between companies is then investigated where typical issues faced by large companies and SMEs are presented.

A classification of collaborative relationships is then developed based on a review of existing approaches, which takes inspiration from Nielsen (2004), Dowell, Morrison and Heffernan (2015), Wang, Peverelli and Bossink (2015) and Tobiassen and Petersen (2018) and considers the four phases of relationship formation, implementation, evolution and conclusion.

Using each phase of the collaborative relationship classification and specific activities as a template, the main issues regarding trust and sharing of practical

knowledge are compared and contrasted from a large company and SME perspective.

Chapter Three:
This chapter outlines the research philosophy, paradigm, methodology and associated methods used to collect and analyse the qualitative data produced by this research. Presented also is the justification for the methods used to both collect and analyse the data and associated processes. Limitations of the research design are then presented along with details of how ethical and consensual issues have been addressed.

Chapter Four:
This chapter presents the findings of a thematic analysis and narrative analysis for two core themes that have been identified within the qualitative data for research questions one and two. A cross-case analysis is then presented where the findings from the narrative analysis are compared. All forms of analysis use data from three sample case studies from the SME sub-group of participants.

Chapter Five:
This chapter presents the findings of the thematic and narrative analysis for two core themes identified within the textual data for research questions one and two. Data from three sample case studies are used from the Large company sub-group of participants. A cross case analysis is then presented where the findings from the narrative analysis are compared along with supporting data.

Chapter Six:
This chapter compares the findings from the cross case analysis for both company sub-groups using a form of analysis of narratives, which is then compared with that of the literature. Ancillary core themes are included in the analysis to consider important observations related to the themes that have a similar or lower number of references in the thematic analysis.

For research question three, a novel method devised in this research called narrative mapping is used to conduct a form of analysis of narratives for each of the relationship phases as identified in this investigation. The findings of the analysis are then compared and contrasted with the literature.

Chapter Seven:
This chapter provides an overview of the research design, summary of the findings and details of the research outcomes. Limitations and further work are then presented along with the main contributions provided by the research.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

The literature review considers the main literature streams of trust, knowledge sharing and collaborative relationships and clearly establishes what research exists related to each of the research questions as outlined in chapter one.

To date, a considerable amount of research has investigated how knowledge is shared in various types of organisations (e.g. Staplehurst and Ragsdell 2010). More recently, researchers have investigated how knowledge is shared in SMEs and have acknowledged the important role of trust in facilitating the knowledge sharing process (e.g. Cheng, Yeh and Tu 2006). More specifically, it has however been noted that no research has been undertaken to understand how trust influences the way engineering practitioners share practical knowledge in technology producing SMEs.

Research that has investigated the sharing of practical knowledge has received limited attention. For example, Tunsi, Guzman and Shacklock (2012) who formulated a conceptual framework of practical knowledge sharing, did not examine the role of trust in facilitating the sharing of practical knowledge.

First of all, this chapter establishes how trust as a concept has been understood through its classification and measurement. A working definition of trust from Mayer Davis and Schoorman (1995) is also outlined that will be used in this research. Trust based relationships are then characterised in general terms and then from a small to medium company perspective.

Knowledge sharing is then considered from four perspectives; general influential factors, SME, practiced based, and tacit knowledge. Firstly, knowledge sharing is examined from a general perspective to establish why it is important and the factors that typically influence it. The characteristics of small to medium companies from Ghobadian and Gallear (1997) are then considered and how these either promote, or inhibit the sharing of knowledge. Some of the items

identified are then contrasted with the working practices of large companies. The relationship between knowledge sharing and organisational culture is then examined specifically from both SME and large company perspectives.

The conceptual foundations of practical knowledge are then investigated by discussing various practice based theories. Practical knowledge sharing is then introduced and the complexity of this concept demonstrated by comparing and contrasting practice based theories at the individual and organisational levels. In doing so, the research gaps are highlighted with regards to the consideration of trust. A similar approach is then adopted for the sharing of tacit knowledge.

Trust development in collaborative relationships that are formed at the dyadic level (Miller 2009) both within and between companies, are then investigated, and typical issues faced by personnel in general terms and then technology producing small to medium enterprises.

Based on a review of existing models of collaborative relationships, a classification has been developed taking inspiration from the work of Nielsen (2004), which considers the four phases of relationship formation, implementation, evolution and conclusion.

Using each phase of the collaborative relationship classification as a focus, the main issues regarding trust and the sharing of practical knowledge are considered from a large company and SME perspective. Specific topics considered for each phase are; partner identification and selection (Hitt et al. 2000), contract negotiation (Blomquivst, Hurmellina, Seppănen 2005) (including NDAs and knowledge disclosure), informal learning (Eraut 2004a), and collective reflection (Rantatalo and Karp 2016). Typical knowledge sharing mechanisms used in each relationship phase are identified. It should be noted that knowledge sharing mechanisms, will take inspiration from the work of Boh (2007) who has defined various methods such as personal networks, communities of practice, standardised processes and boundary spanning.

Based on the main observations drawn from each sub-section, tentative propositions on how trust may facilitate effective sharing of practical knowledge for each of the four collaborative relationship phases as noted previously are then presented.

2.2 TRUST

This sub-section discusses the nature of trust and how researchers' understanding of it has developed by investigating how it is classified and measured.

2.2.1 NATURE OF TRUST

Trust is important in all various forms of social life. For example, trust acts as a mechanism for developing relationships (Gibbons 2004), and facilitates on-going dialogue in negotiations between two parties (Olekalns and Smith 2005). Trust also reduces transaction costs in inter-organisational exchanges (Bharadwaj and Matsuno 2006).

The phenomena of trust has been investigated in a number of areas, namely sociology, psychology, philosophy, management, marketing and computer science (e.g. human and computer interaction and E-Commerce) to name a few. As a result, trust has been defined in numerous ways where it has mostly been described as belief, state or expectation. For example, Sztompka (1999) defines trust as *"an expectation that an entity, organisation, group, or individual with whom a party may get in contact with, will act with the best interests of the other party".*

One of the most widely adopted definitions by researchers is that proposed by Mayer, Davis and Schoorman (1995), who define trust as *"the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party"*.

Three primary forms of trust have been identified by theorists as affective, cognitive and behavioural trust (Lewis and Weigert 1985; Blomqvist, Sundqvist

and Soininen 2002). Cognitive-based trust is founded on the thinking (cognitive) process and confidence an individual has, based on 'good reasons', which constitute evidence for trustworthiness (Lewis and Weigert 1985). Affect-based trust is founded on the basis of emotional bonds developed between people who participate in a relationship (Blomqvist, Sundqvist and Soininen 2002). It is this aspect of trust, which contributes to the cognitive aspect from which it is developed and sustained (Lewis and Weigert (1985). Behavioural trust, comprises actions which come from cognitive and affective states (Lewis and Weigert 1985).

In addition to the definition of trust, as outlined by Mayer, Davis and Schoorman (1995), the authors also propose an integrative model of organisational trust, composed of the following elements of a trustor and trustee, commonly referred to collectively as a 'dyad' (Miller 2009), and outlined in Figure 1.

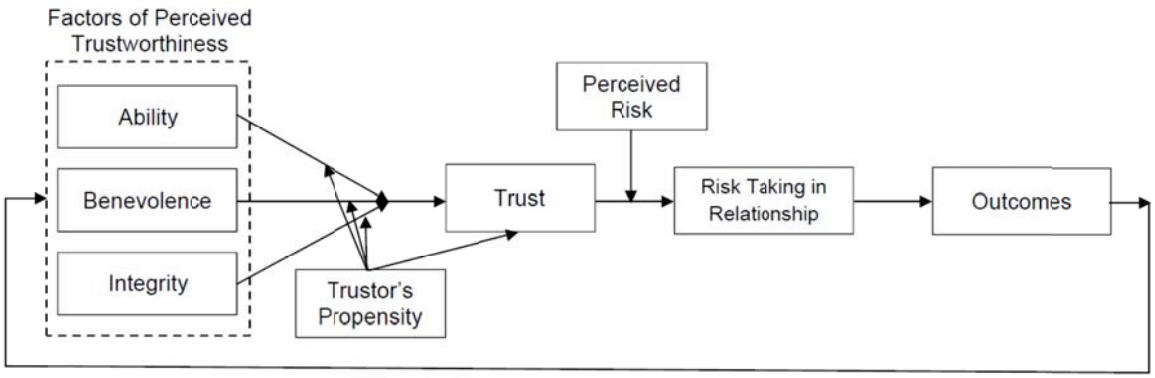


Figure 1: Integrative Model of Organisational Trust
(Mayer, Davis and Schoorman 1995)

The integrative model of organisational trust as originally formulated by Mayer, Davis and Schoorman (1995) is characterised by trust antecedents and trust consequences. Trust antecedents are composed of trustworthiness variables (ability, integrity and benevolence) and trust propensity; all of which are necessary to bring about trust. Trust consequences involve perceived risk, risk taking and outcomes (Mayer, Davis and Schoorman 1995).

Trustworthiness variables or dimensions are essentially criteria by which a trustor may use to establish the trustworthiness of the trustee and all three address the three forms (cognitive, affective and behavioural) of trust as follows.

Ability relates to the cognitive component of trustworthiness, where the trustee is considered to have the relevant skills and abilities (Mayer, Davis and Schoorman 1995). Integrity relates to both cognitive and affective components of trustworthiness (Barnard, Schunk and De Beer 2008) where the trustee is considered to use rules that would be acceptable to the trustor. Finally, benevolence, which directly relates to the affective component of trustworthiness, where the trustee is judged on their ability to do good in the eyes of the trustor (Mayer, Davis and Schoorman 1995).

Mayer, Davis and Schoorman, point out that the trustworthiness dimensions of ability, benevolence and integrity appear to encompass a large proportion of trust strategies adopted. Recent research on trustworthiness measurement, appears to use these variables, or dimensions (e.g. Jones and Shah 2016).

Whilst at the time the model proposed by Mayer, Davis, Schoorman (1995) was initially based on theoretical research, it should be noted that subsequent research has applied this model and confirmed it to be robust at analysing dyadic relationships within and between organisations (Schoorman, Mayer and Davis 2007). Given the nature of this research, Mayer, Davis and Schoorman's (1995), definition of trust will be adopted in this investigation.

As this research investigates the relationship between trust and sharing of practical knowledge, Mayer, Davis and Shoorman's (1995) model is also selected as this provides an indication of the micro-foundations of trust and how its constituent elements are developed through collaborative working. Other typical trust development models such as for example the model proposed by Lewicki and Bunker (1996), provides broad details of how trust develops in collaborative relationship phases, however such an approach does not specifically characterise trust in terms of its component parts.

Researchers who have analysed different trustworthiness variables, appear to have used definitions of trust more specifically based on the context of their own research (e.g. Chow and Holden 1997; Dyer and Chu 2000). When examining the determinants of trust in 453 automaker/supplier relationships in the U.S, Japan and Korea, Dyer and Chu (2000) draw on previous definitions from for example Dore (1983) that trust is one party's confidence that another party (in the relationship) will not exploit its vulnerabilities. This confidence, or trust is expected to develop where the trustworthy partner(s) will:

- Make good efforts to act in ordnance with prior commitments;
- Make adjustments that are deemed fair by the other partner;
- Will not take advantage of the other partner, when the opportunity arises.

Based on the aforementioned scenarios, Dyer and Chu (2000) use trustworthiness measures based on reliability, fairness and goodwill. In this study it is noted that in all countries, supplier trust was found to be highly correlated with routine buyer processes which signified a commitment to relationship development.

2.2.2 TRUST CLASSIFICATION AND MEASUREMENT

Early research has adopted definitions of trust in numerous fields, such as those noted in the previous section and survey instruments have been developed with the aim of measuring generalist forms of trust. For example, Rotter (1967) developed a survey instrument which utilised scales to measure interpersonal trust or trust propensity.

It is also noted that since Mayer, Davis and Schoorman (1995) developed their trust model, a large proportion of quantitative trust research has adopted in full, or in part the principles as outlined by the aforementioned authors. For example survey instruments with rating scales based on Mayer, Davis and Schoorman's trust model have been developed and analysed using a variety of statistical methods. For each of the items (classifications) mentioned in the Integrative Model of Organisational Trust in Figure 1, survey items have been developed by researchers and examples of these are outlined in Table 1.

Trust measures have been broadly categorised into measuring trust antecedent variables and the consequences of trust taking (Colquitt, Scott and LePine 2007). The aforementioned authors have identified that these measures can be further divided into sub-sets of willingness to be vulnerable, direct and positive orientation. A detailed treatment of each of these scales will not be covered here; however when providing example measurements for trustworthiness, trust propensity and trust consequences, the types used will be explained.

The scale types refer to how the questions are framed, for example those listed for the trustworthiness variables in Table 1 are in willingness to be vulnerable format, where the three trustworthiness variables are outlined within each question. The trust propensity scale as originally formulated by Rotter (1967) is of a direct type where trust is referred to in general terms.

Trust Items (Category and Definition)	Example Survey Items
Trust Antecedents	
Trust Worthiness (of Trustor) Ability: A group of skills, competencies, and characteristics that enable the Trustor to have influence in some specific domain (Mayer, Davis and Schoorman 1995).	[The degree to] which the Trustee is capable of performing the Trustee's job (Mayer and Davis 1999).
Benevolence: The extent to which the Trustor is believed to want to do good to the Trustor (Mayer, Davis and Schoorman 1995).	[The degree to which] the Trustee is concerned about the Trustor's welfare (Mayer and Davis 1999).
Integrity: The perception that the Trustee will adhere to some guiding principles that the Trustor will find acceptable (Mayer, Davis and Schoorman 1995).	[The degree to which] the Trustee's actions and behaviours are consistent in the view of the Trustor (Mayer and Davis 1999).
Trust Propensity: Willingness of the Trustor to trust the Trustee (Mayer, Davis and Schoorman 1995).	[The degree to which] the Trustor will trust the Trustee. (e.g. Interpersonal Trust Scale Rotter 1967).
Trust Consequences	
Trust: Level of Trust the Trustor has in the Trustee (Mayer, Davis and Schoorman 1995).	[The degree to which] the Trustee would let Top Management have influence over issues that are important to the Trustee (Mayer and Davis 1999)
Risk Taking: A specific choice that creates a behavioural manifestation of the willingness to be vulnerable (Mayer, Davis and Schoorman 1995).	[The degree to which] or [indices related to] the choice to share information openly (Colquitt, Scott and LePine 2007)
Trust Outcome: Outcome resulting from a behavioural manifestation of the willingness to be vulnerable (Mayer, Davis and Schoorman 1995).	[The degree to which] or [indices related to] the performance of a task are achieved (Colquitt, Scott and LePine 2007)

Table 1: Trust Items and Example Survey Items

Trust measurement based on trustworthiness variables is relatively common place (e.g. Hallikainen and Laukkanen 2018), however some authors have noted some shortcomings when using such an approach. Ability, integrity and benevolence as variables may be distinct in theory, but inseparable in practice therefore devising one measurement scale for each item may not be practical. For example, when measuring trustworthiness Gabbaro (1978), advised that the

integrity and benevolence data might yield similar results thereby making each other redundant.

Research conducted by Collquitt, Scott and LePine (2007) has however shown that each antecedent is uniquely correlated to trust and therefore signifies that measuring each item separately may be appropriate. The unique relationship with trust may be because the cognitive aspects (e.g. ability and integrity) may be complemented by the affective aspect of trustworthiness such as benevolence in a relationship (Lewis and Weigert 1985).

After considering the trustworthiness of a trustee, the trustor will then need to make a decision to trust (Mayer, Davis and Schoorman 1995). Research that has investigated the measurement of trust propensity has investigated its relationship with the trustworthiness variables, and trust at the inter-personal and inter-organisational levels.

Research conducted by Colquitt, Scott and LePine (2007) have also found that trust propensity is in fact significantly correlated to trust taken indicating that measuring this may be appropriate. The authors' research found that trust propensity is also strongly correlated to all the trustworthiness variables, indicating that all variables (trustworthiness and trust propensity) impacted on participants' decision to trust.

Trust propensity has typically been measured at the individual level as interpersonal trust and organisational level. Seppanen, Blomqvist and Sundqvist (2007) comment that most research that has investigated inter-organisational trust measurement has been problematic as it has formulated theory based at the firm level whilst measuring trust at the level of an individual. Currall and Inkpen (2002) comment that this misspecification of trust is common place. Zaheer, McEvily and Perrone (1998) for example have acknowledged the aforementioned problem and to address it they devised two separate measures for inter-personal and inter-organisational trust.

More recently, research conducted by Hallikainen and Laukkanen (2018) investigated whether and how a disposition to trust mediates the relationship between national culture and trustworthiness of an online store. The research sampled approximately six hundred online bookstore customers from Finland and China, who have vastly different cultural backgrounds. In doing so Hallikainen and Laukkanen developed twenty six questions; including five cultural dimensions (Hofstede 1980), six trust propensity questions (positive orientation scale type) and ten trustworthiness questions (positive orientation scale type). This research found the mediating role of trust deposition between national culture and trustworthiness is dependent on the individual cultural dimension being studied. In other words, the relationship between natural culture and trust is inherently complex.

Noteboom, Berger, Noorderhaven (1997) have also acknowledged that an individual's trust perception is affected by an organisation's culture and in response formulated a trustworthiness measurement (positive orientation scale type) based on institutionalisation and habitualisation.

When generally considering the measurement of trust consequences, research appears to show that it fosters risk taking and promotes organisational performance (e.g. Allen, George and Davis 2018).

When investigating the effect of a performance appraisal system on employees' trust in management of a small plastics company in the U.S., Mayer and Davis (1999) found that trustworthiness moderated the relationship between employees' understanding of the performance system and trust. In order to conduct the research, Mayer and Davis devised measurements for trust taken, perceived performance accuracy and performance appraisal outcome (willingness to be vulnerable scale type for all three measures). Whilst conducting their analysis, Mayer and Davis (1999) observed that the reliability of the two performance appraisal measures to produce consistently high correlation coefficients (alphas of around 0.7). The correlation coefficients for the trust measure however were found to drop slightly from 0.75 to 0.66, thereby indicating that it was less reliable. Mayer and Davis (1999) provide an

explanation from Cortina (1993) that alphas must be interpreted with the number of items (scale length) in mind. It is however noted that Mayer and Davis used a five point Likert scale and five to eight questions for most measures. The trust measure however had four questions, which may also account for some variation in the reliability data (Tavakol and Dennick 2011).

2.2.3 TRUST BASED RELATIONSHIPS

In order to consider how trust based relationships are developed in SMEs, trust development is considered in a general sense where conceptual underpinnings are outlined, trust relationships are characterised and trends in the way they develop are noted.

Trust development in relationships is best understood through understanding how trust relates to the concept of social capital. Trust researchers have observed that working relationships based on mutual trust tend to exhibit more social capital (Kale, Singh and Perlmutter 2000).

Whilst there are numerous definitions of social capital, one suitable informal definition is the inherent value of a relationship, which is brought about by the access to resources and economic opportunities (Coleman 1988). It is noted that more recent research in this area has resulted in the view that social capital has both a structural dimension and relational dimension (Kostova and Roth 2003). Where the structural dimension relates to the connections between two companies, these are the means by which two partnering companies share knowledge (McFadyen and Canella 2004).

The relational dimension of social capital corresponds to the inherent nature of a relationship between two individuals or companies, such as tie strength (Levin et al. 2015). As such, it can be observed that it is the relational dimension that is influenced by trust; however this factor alone is not sufficient to develop a relationship. As a result, social capital is produced by exchange, which in turn facilitates further exchange (Nahapiet and Ghoshal 1998).

Some notable characteristics of trust based relationships identified are as follows:

- Development of familiarity through repeated transactions, mutual understanding and communication.
- The frequency of interaction between partners.
- Development of a history of interactions.
- Trust development as an interactive process of learning and unlearning.
- Trust acting as an informal control mechanism.

Familiarity through repeated transactions tends to be related to trust between organisations and therefore it has been observed as a key feature of relationships based on trust (Gulati 1995 and McEvily, Perone and Zaheer 2003). In a similar vein, whilst analysing how trust develops at both the organisational and individual level, Currall and Inkpen (2002) observed that trust developed at the individual level was translated to organisational level at lower levels through understanding each other's know how, operations and dominant logic.

As already outlined in a previous sub-section when investigating the relationship between an automotive company and its suppliers, (Dyer and Chu 2000) the frequency of interactions between partners may also be considered as another important indicator of the commitment of resources to a project.

Gulati (1995) observed that partners who have developed a long history together can take each other for granted, whilst not considering the benefits of other partners for projects. Ireland, Hitt and Vaidyanath (2002), on the other hand view the accumulated history between companies helps foster trust and predict each other's behaviours.

Six and Sorge (2008) comment that inter-personal trust-based relationships are characterised by individuals who learn and unlearn to establish and maintain trustworthiness under a specific set of organisational settings. The authors identify a specific set of inter-related policies that promote interpersonal trust, these being; promotion of a relationship-oriented culture, facilitation of explicit

relational signalling; consistent and regular organisation of Informal meetings, induction training and daily management of competencies.

Zaheer, McEvily and Perrone (1998) observed that increased trust reduced the level of conflict and negotiation costs at both the inter-personal and inter-organisational levels. When studying alliances formed between organisations, Gulati (1995) observed that trust resulting from partners' experiences reduced the likelihood of having to employ costly procedural controls. This research demonstrates the ability of trust to act as an 'informal' type of control mechanism. It is also acknowledged that trust may be used in numerous other ways to control project activities for example when negotiating contract terms (e.g. see Woolthius, Hillerbrand and Noteboom 2005).

2.2.3.1 TRUST BASED RELATIONSHIPS IN SMEs

Like their larger counterparts, SMEs do business by forming relationships with other companies, in turn providing growth opportunities for those SMEs who have specialist skills, which could be connected to specific needs of companies in for example in foreign markets (Törnroos 2002). Sources of growth opportunities identified by Zhou, Wu and Luo (2007) include knowledge of foreign market opportunities, advice and experiential learning, and referral trust and solidarity.

Fink and Kraus (2007) found that the establishment of trust based relationships between SMEs and foreign partners positively affected the performance of the partnering company.

The forms of trust based relationships outlined previously will be used to consider how such relationships are characterised for SMEs, which are summarised in Table 2.

The flexible, flat, organic structures of Small to Medium Enterprises as noted by Ghobadian and Gallear (1997), Van de Vrande, de Jong and Vanhaverbeke (2009) and Staple and Ragsdell (2010) will facilitate the development of familiarity through repeated interactions between personnel. It is noted in particular that a unified culture employed by the CEO/owner of SMEs may be

instrumental in promoting mutual understanding with all personnel (Ghobanian and Gallear 1997). On this issue it is noted further from Zucker (1986) that the form of trust adopted by personnel may well be based on the owner's personality.

More recent research by Hadjielias and Poutziouris, (2015) has highlighted the central role of trust based relationships in developing altruism, collective thinking, stewardship norms and sustaining collaboration between family run SMEs.

Trust Based Relationship (TBR) Characteristic	How TBR Characteristic is realised by SMEs
• Development of familiarity through repeated transactions, mutual understanding and communication. • The frequency of interaction between partners.	• Flexible, flat organisational structures and heuristic processes with entrepreneurial working practices (Ghobadian and Gallear 1997; Van de Vrande, de Jong and Vanhaverbeke 2009 Staplehurst and Ragsdell 2010) [PRO] • Unified culture (Ghobadian and Gallear 1997) [PRO]
• Development of a history of interactions.	• In some industry sectors, some SMEs have difficulty in finding partner organisations to work with and hence may be careful when selecting partnering organisations (Lee et al, 2010) [CON} • SME Networking to facilitate rapid growth (Möller, Rajala, and Svahn 2005) [PRO]
• Trust development as an interactive process of learning and unlearning.	• Balancing exploration and exploitation through unlearning (Cegarro-Navarro, Sanchez-Vidal, and Cegarro-Leiva, 2011) [PRO/CON] • Resource development through B2B (SME/Large) Relationships (Bocconcelli, Mumura, and Pagano 2018) [PRO]
• Trust acting as an informal control mechanism.	• Trust Governance and Performance (Rus and Iglic 2005) [PRO/CON] • Trust and Contracting (Blomquivst, Hurmellina, Seppänen 2005) [PRO/CON]

Table 2: Trust Based Relationships of SMEs

(Note: Pros and Cons are highlighted against each TBR characteristic in square brackets).

SMEs' ability to develop a history of interactions may be problematic in the way that they operate. For example it has been noted from Lee et al. (2010) SMEs invariably have problems in finding partners to work with and are therefore cautious when selecting partners to collaborate with.

Company networking is one way in which a history of interactions can be developed. Trust based relationships provide growth opportunities for SMEs who may use their specialist knowledge and skills to meet the needs of foreign customer organisations and drive rapid growth (Tömroos, 2002 and Möller, Rajala, and Svahn 2005).

Networking by SMEs, can also be used at both the exploration and exploitation stages of their innovation process. Examples of these strategies are reflected by Lee et al, (2010) who identified that at the exploration stage, SMEs may well network in a way that helps them retain competence in core aspects of their company. At this stage the authors comment that SMEs typically form partnerships with various forms of public and private organisations such as private/public research bodies and Universities. Conversely, when exploiting new knowledge, SMEs may look to develop new competences. When networking in this manner Lee et al. (2010) observe that SMEs may form relationships with large companies where outsourcing agreements or strategic alliances may be formed.

For most organisations, and particularly SMEs, however Cegarro-Navarro, Sanchez-Vidal, and Cegarro-Leiva (2011) note that achieving a balance between exploration and exploitation is difficult, where personnel may be trapped in a suboptimal stable equilibrium where they may be cutting back on resources and over-investing exploration and exploitation processes. In order to achieve this balance the authors suggest that SMEs should create conditions for unlearning. Where in the context of this research, conditions for unlearning refer to the readjustment of an organisation's culture by formulating new mental models (Duffy 2003) and core assumptions that inform behaviours (Shaw and Perkins 1991).

In the case of knowledge exploration, large companies invariably work with their suppliers to develop new working practices together, such as for example lean supply chain systems through meetings and workshops (Murmura and Bravi 2017), where joint learning efforts are facilitated through relational trust (Selnes and Sallis, 2003). In addition, Holmqvist (2004) notes that knowledge exploration and exploitation are both interdependent and as such, it can be deducted that the development of relational trust plays a central role in both activities.

Research conducted recently by Bocconcelli, Mumura, and Pagano (2018) have highlighted how resource development takes place in B2B relationships formed between one SME who supplies mechanical components to three customers who are all large companies in Italy.

Using an interactive approach to conduct their research, Bocconcelli, Murmura and Pagano, (2018) observe how the resources of one small company and three of its key customer organisations were developed to improve their product quality levels, logistics and product delivery lead times. In order to meet these requirements, lean supply chain management (Free Pass Model) and associated JIT related working practices had been implemented in all four companies.

Bocconcelli, Murmura and Pagano's (2018) research demonstrates how the trust based supplier-customer relationships change through the combination and integration of technical and organisational resources. Whereas initially, the relationships are based on the joint coordination of complex individual organisational processes, with time, these develop progressively through the joint adoption of formalised cross-company operational routines. It is noted that such a joint adoption of cross-company working practices typically requires mutual learning, which can act as mechanism for developing trust further and impact on decisions about control between partners (Inkpen and Currall 2004).

Trust research has also demonstrated that the type of trust exhibited between two companies influences the choice of governance mechanisms used to coordinate their activities, which in turn impacts on company performance.

When investigating the relationship between trust and control in SMEs in Slovenia and Bosnia-Herzegovina, Rus and Iglic (2005) found that in the case of Slovenia where the company environments were found to promote higher levels of institutional trust, their business relationships were found to be based on trust rather than contracts. Conversely, in Bosnia-Herzegovina Rus and Iglic (2005) found that as their organisational environments were found to promote lower levels of interpersonal trust, their business relationships were found to be based on contracts.

When considering company performance, Rus and Iglic (2005) noted that collaborative relationships based on institutional trust as a governance mechanism lead to increased performance as the social patterns and views reached beyond a specific group of individuals. In the case of interpersonal trust, as evidenced by SMEs in Bosnia-Herzegovina, company performance was found to be lower due to the trust demonstrated by the strong ties exhibited between a discrete, smaller number of groups (Rus and Iglic 2005).

As noted earlier, both large and small companies may engage in collaborative relationships to take advantage of each other's strengths to develop new products and services. Whilst large companies might have greater financial resources, know-how and distribution systems, SMEs are more likely to have more flexible organisational capabilities and innovative products and services (Ghobadian and Gallear 1997; Blomquivst, Hurmellina, Seppănen 2005). Clearly, such collaborations exhibit an imbalance of power and resources in favour of the large company and may provide challenges for the smaller partner as noted by Jones et al. (2014) and are commonly known as being 'asymmetric' (Blomqvist 1999).

Whilst Rus and Iglic (2005) investigated trust being used in place of formal contracting procedures between partners, Blomquivst, Hurmellina, Seppănen (2005) investigate how trust can be used within a contracting process to effectively build trust between asymmetric partners.

For asymmetric collaborations to develop effectively, it is believed that the design of the contracting process is the most important item as this will ultimately determine how the contract and trust threshold(s) are developed and how partners deliver the project. Blomquivst, Hurmellina, Seppănen (2005) confirm this view when they refer to an example between one large company and supplier, where a detailed contract had been drawn up between them by a professional law company. As the terms within the contract were often the subject of many disputes, very little trust developed between the two companies.

2.2.4 SUMMARY OF FINDINGS FOR TRUST

Summary of the findings from this sub-section are as follows:

- Trust has been investigated by researchers in a number of fields most notably sociology, psychology, philosophy, management, marketing and computer science (i.e. human and computer interaction and E-Commerce) to name a few. Three primary forms of trust are affective, cognitive and behavioural trust.
- The integrative model of trust as proposed by Mayer, Davis, and Schoorman (1995) has been identified as an influential piece of work which proposes a model outlining the constituent components of trust they are; trust antecedents (which are typically ability, benevolence and integrity) trust propensity, trust taken, perceived risk, risk taking and outcomes.
- Trust has typically been classified and measured in terms of its trust antecedents and trust consequences where survey instruments have been used to measure the trustworthiness and trust propensity of a specific sample group of individuals. Items typically measured related to trust consequences using survey instruments include; trust taken, risk taking and trust outcomes.
- Trust based relationships have been found to be characterised by repeated transactions that promote familiarity, history of transactions and trust development that may be used as an informal control mechanism.
- The flexible and flat structures of SMEs make it easy for them to develop familiarity through repeated transactions. SMEs may however find it hard to identify partners. To overcome this issue, SMEs typically network to identify partners to facilitate rapid growth in their operations.

- Collaborative relationships formed by SMEs with larger companies who are seen to be more powerful are defined as being ‘asymmetric’ (Blomqvist 1999). Asymmetric collaborations have been highlighted within the literature by as being problematic however notable research undertaken for example by Blomqvist, Hurmelinna, and Seppänen (2005) propose how the contracting process can be balanced to ensure effective trust development is assured between both partners.

2.3 KNOWLEDGE SHARING

This sub-section will consider knowledge sharing from four perspectives; general influential factors, culture, practiced based theories, and tacit knowledge. The first part considers knowledge sharing from a general perspective to establish why it is important, and factors that typically influence it generally and within SMEs. The abilities of SMEs to conduct knowledge sharing activities are then considered from a cultural perspective using Hofstede’s cultural dimensions (Hofstede, Hofstede, Minkov 2010). In doing so, an outline of an SME knowledge sharing culture is characterised.

Notable practice based theories that demonstrate how both explicit and tacit knowledge is shared in organisations are then reviewed with the aim of identifying deficiencies and research gaps that will be exploited by this research.

2.3.1 KNOWLEDGE SHARING FACTORS

Knowledge sharing is the fundamental means through which employees can apply knowledge and innovate, thereby contributing to the competitive advantage of an organisation (Jackson et al. 2006). By sharing knowledge between individuals, teams and organisations in such a manner, allows them to capitalise on their knowledge resources (Cabrera and Cabrera 2005). Research has shown that knowledge sharing has a positive impact on an organisation’s performance. Examples include faster completion of new product development projects and overall reduction in production costs (Hansen 2002; Arthur and Huntley 2005).

In addition to the activity of sharing knowledge, Boh (2006) argued that knowledge sharing mechanisms are important means to leverage the learning, experience and expertise of personnel. In this research, Boh distinguished between two dimensions of personalisation versus codification and individualisation versus institutionalisation. These dimensions highlight the various forms in which knowledge can co-exist within a company. An individualised-personalisation mechanism for example being ad-hoc, informal knowledge in social networks (Boh 2006).

Research undertaken by Ipe (2003) and Rehman, et al. (2011) identified a number of factors that affect knowledge sharing. Factors that are of relevance to this investigation include, company size and structure, culture and climate of work environment, nature of knowledge, motivation and opportunities to share, rewards, stressors and job type.

In addition to the factors mentioned, Ipe (2004) further identified motivators and inhibitors to knowledge sharing. Motivators include; feelings of being valued, informal relationships, commitment to the project, and a sharing climate within project teams. Inhibitors include; lack of shared contexts, the tacit nature of knowledge, dependence on individuals abilities to manage the sharing process, the cost of sharing, and the project setup process and structure.

All the factors as identified previously by Ipe (2003) have implications for both large and small companies alike. In particular it is noted by the author that an organisation's culture is one of the most important variables, as it impacts to a large extent on how and what knowledge is valued, the kind of relationships formed, rewards for knowledge sharing and opportunities (formal/informal) to share knowledge by personnel.

More recent research conducted by Baker and Ellis (2018) acknowledged the influence an organisation's culture has on its ability to share knowledge and analyse the interaction of both items and consider knowledge sharing as two discrete activities; knowledge seeking and knowledge contributing. The research

conducted by Baker and Ellis found a competitive organisational culture had a positive relationship with knowledge contributing with knowledge seeking acting as a moderating variable (Baker and Ellis 2018). In addition a competitive organisational culture when mixed with a bureaucratic culture was found to have a negative relationship with knowledge seeking, and positive relationship with knowledge seeking with a clan (family like) culture. This finding broadly agrees with the research conducted by Park, Ribiere and Schulte (2004) who investigated specific aspects of organisational culture on the implementation of knowledge management technology. Items that were found to have a positive correlation were team oriented work, close working with others, free sharing of information, and trust. Items that were found to have a negative correlation were being calm, compliance, stability, detailed working approach.

Durmusoglu et al. (2014) investigated the role of rewards and culture in promoting knowledge sharing and gaining in one large multinational corporation, which operates in ten different industries and nine different countries. The authors found that knowledge gaining was influenced by rewards alone, even in the absence of a culture that supported such activities. This finding seems to be the opposite that reported by Baker and Ellis (2018), however it is noted that all of the participants within the sample worked in the same company.

When investigating the working practices of twenty three knowledge intensive manufacturing companies in Italy, Cavaliere Lombardi Giustiniano (2015) found that individual, organisational and technology factors had a positive impact on the way they shared knowledge. It is noted that for technology factors the use of ICT directly influenced knowledge donating and collection, whilst indirectly related to knowledge sharing. Cavaliere Lombardi Giustiniano (2015) noted that this is based on the belief of personnel who see ICT as way of connecting people in different parts of the company and hence invited them to share knowledge with colleagues.

Like organisational culture, trust has also been identified as an important factor influencing the way companies share knowledge.

Casimir, Lee and Loon (2012) found that affective trust of the 500 participants surveyed moderated the relationship between affective commitment and knowledge sharing and also the relationship between knowledge sharing and its cost. This finding suggested that participants who valued social relationships tend to view knowledge embodied within such relationships as a collectively owned commodity. As such, the findings also indicated that an organisational culture based on affective trust may also promote knowledge sharing (Casimir, Lee and Loon 2012).

Rutten, Blaas-Franken and Martin (2016) investigated the relationships between high and low affect based trust and cognitive trust on the sharing of explicit and implicit knowledge. The findings indicated that the level of knowledge sharing was found to correlate with low versus high trust situations. In addition, the authors found a significant positive relationship between affect based trust and the sharing of implicit (tacit) knowledge. The research conducted by Casimir, Lee and Loon (2012) and Rutten, Blaas-Franken and Martin (2016) both agree with the findings of McAllister (1995) who highlighted the important role of affect (benevolence) based trust in facilitating interpersonal cooperation.

Most recently, Choi and Cho (2019) investigated the mechanism by which trust influences collaboration in virtual teams. The authors found that trust was critical in all aspects of collaboration, where cooperation and coordination where found to enhance knowledge sharing. Quite interestingly, Choi and Cho found that those virtual teams that had strong autonomy exhibited higher trust and greater collaboration than those teams that had low or weak autonomy. In addition, it was observed those teams that executed complex tasks exhibited higher trust than those teams that executed more simplified routine tasks.

2.3.2 KNOWLEDGE SHARING CULTURE OF TECHNOLOGY PRODUCING SMEs

Small to medium companies have inherent characteristics, which either facilitate or inhibit knowledge sharing. Table 3 outlines the facilitators and inhibitors of SMEs in their ability to share knowledge effectively.

FACILITATORS:
• Flexible, flat organisational structures and heuristic processes with entrepreneurial working practices to leverage their internal resources (Ghobadian and Gallear 1997; Van de Vrande, de Jong, and Vanhaverbeke 2009; Staplehurst and Ragsdell 2010; Slocinska and Depta 2015) • Organisational structures have been adapted to implement and sustain collaborative initiatives (Van de Vrande, de Jong, and Vanhaverbeke 2009) • Adept at identifying core competencies and outsourcing research and related services (Van de Vrande, de Jong, and Vanhaverbeke 2009) • Appear to use networks in both exploitative and exploratory modes (Lee et al, 2010; Meriläinen, Vuori, Helander 2017) • Small Polish companies exhibited feminine type cultures where personnel were cooperative and willing to share knowledge without receiving any benefits (Prystupa-Rządca 2017)
INHIBITORS:
• SMEs with masculine, assertive cultures placed a higher importance of secrecy when managing Intellectual Property (Delerue and Lejuene (2011). • Lack of Time, Experience, Interpersonal skills and transparent rewards (Staplehurst and Ragsdell 2010, Durst and Wilhelm 2012); • Co-opetition entails sharing knowledge between two companies. Levy, Loebbecke and Powell (2001) observe that the knowledge gained by co-operation may also be used for competition; • Some SMEs employ tactics to mitigate and exploit the forces of Co-opetition; synergy, leverage, and negative reverse impact, though their efforts are largely unsuccessful (Levy, Loebbecke and Powell 2001); • Lack of human resources, Poor qualifications, lack of technological resources and Motivational issues (Vajjhala and Vucetic, 2013; Slocinska and Depta 2015; Cherchione, Esposito, Spadaro 2015); • Invariably use intermediary organisations to broker relations with other companies (Lee et al. 2010); • Some SMEs, may engage in arms-length relations where neither company are willing to take a risk (Lane and Bachmann 1996); • In some industry sectors, some SMEs have difficulty in finding partner organisations to work with and hence may be careful when selecting partnering organisations (Lee et al. 2010).

Table 3: Facilitators and Inhibitors of SMEs' Knowledge Sharing Abilities

The aforementioned characteristics will be reframed using Hofstede's cultural dimensions (Hofstede Hofstede and Minkov 2010) and considered with other related literature to characterise knowledge sharing from a cultural perspective. Whilst it is acknowledged that Hofstede, Hofstede and Minkov (2010) developed cultural dimensions for application within an organisational context, the cultural dimensions applicable to national cultures will be applied, as these enable the comparison of knowledge sharing practices between different company sizes. It is also noted that a similar approach has been used by Fai Pun and Jaggernath-Furlonge (2012) when investigating the impact of company size and culture on quality management practices in manufacturing organisations. Hofstede's

organisational cultural dimensions with a summary of what each dimension means are shown in Table 4.

DIMENSION:	DESCRIPTION:
Individualism and Collectivism [Ind/Col]	The degree to which people are integrated into groups. Individualism refers to a culture with loose ties where individuals only take care of themselves and their immediate group. Collectivism refers to a culture with close ties where individuals can expect their colleagues, clan or other in-group to look after them in exchange for loyalty and support.
Power Distance [Low/High]	The extent to which the less powerful members accept and expect that power is distributed unequally. High Power Distance indicates that the hierarchy is clearly established and executed without doubt or reason. Low Power Distance indicates that people question authority and attempt to distribute power.
Uncertainty Avoidance [Strong/Weak]	Refers to a tolerance for ambiguity. Strong Uncertainty Avoidance relates to a culture characterised by stiff codes of behaviour, guidelines and reliance on an absolute truth that dictates everything. Weak Uncertainty Avoidance relates to a culture characterised by fewer regulations, the atmosphere is more relaxed, and practice counts more than principles and deviance is tolerated.
Masculinity Femininity [Mas/Fem]	A Masculine culture is characterised by a preference for achievement, heroism, assertiveness and material success, A feminine culture is characterised by a preference for relationships, modesty, caring for people and a quality of life.
Long-term Orientation/Short-term Orientation [Lon/Sho]	Short-term orientation indicates cultures where traditions are honoured are kept, while steadfastness is valued. Long-term orientation refers to a culture where adaptation, circumstantial and pragmatic problem solving is a necessity.
Indulgence/Restraint [Ind/Res]	Indulgence refers to a culture that allows free gratification of basic and desires related to enjoying life. Restraint refers to a culture that controls gratification of needs and regulates it through strict social norms.

Table 4: Hofstede Cultural Dimensions (Hofstede, 1984; Hofstede, Hofstede, Minkov 2010)

Table 5 lists the typical facilitators and inhibitors of knowledge sharing by SMEs, mapped against Hofstede's cultural dimensions.

FACILITATORS/INHIBITORS:	CULTURAL DIMENSIONS:					
	Individualism /Collectivism	Power Distance	Uncertainty Avoidance	Masculinity Femininity	Long/Short Orientation	Indulgence Restraint
Flexible, flat organisational structures and heuristic processes with entrepreneurial working practices to leverage their internal resources		Low				Ind
Organisational structures have been adapted to implement and sustain collaborative initiatives		Low				Ind
Adept at identifying core competencies and outsourcing research and related services	Col					
Appear to use networks in both exploitative and exploratory modes	Col	Low				
Lack of Time, Experience, Interpersonal skills and transparent rewards					Shor	Res
SMEs with masculine, assertive cultures placed a higher importance of secrecy when managing Intellectual Property				Masc		
Small Polish companies exhibited feminine type cultures where personnel were cooperative and willing to share knowledge without receiving any benefits.				Fem		
Co-opetition entails sharing knowledge between two companies where the knowledge gained by co-operation may also be used for competition			Low		Shor	
Some SMEs employ tactics to mitigate and exploit the forces of Co-opetition; synergy, leverage, and negative reverse impact, though their efforts are largely unsuccessful			Low		Shor	
Lack of human resources, Poor qualifications, lack of technological resources and Motivational issues					Shor	Res
Invariably use intermediary organisations to broker relations with other companies			Low		Shor	
Some SMEs, may engage in arms-length relations where neither company are willing to take a risk.			Low		Shor	
In some industry sectors, some SMEs have difficulty in finding partner organisations to work with and hence may be careful when selecting partnering organisations.			Low		Shor	

Table 5 SME Knowledge Sharing Promoters and Inhibitors Mapped Against Hofstede Cultural Dimensions

2.3.2.1 INDIVIDUALISM AND COLLECTIVISM

SMEs typically undertake initiatives to overcome economies of scale such as the integration of customers, suppliers and users within their working practices.

When exploiting their current technologies, SMEs' team working and flexible processes have enabled them to integrate a customer, who may be an original equipment manufacturer (OEM), or user (Van de Vrande, de Jong and Vanhaverbeke 2009). Similarly, Gassmann (2006) has noted that SMEs have integrated suppliers, which in turn has improved their ability to innovate more effectively.

It is also noted by Van de Vrande, de Jong and Vanhaverbeke (2009) that SMEs were able to integrate their partners at a low cost.

Other approaches utilised by SMEs to provide development opportunities include networks, which may form part of their growth strategy. Lee et al. (2010) identified that SMEs may form partnerships with specialist research bodies and universities to explore new knowledge and formulate new technologies. Alternatively Lee et al. (2010) observed that SMEs may form partnerships with their customer, which may be a large company when they look to exploit their existing knowledge base.

2.3.2.2 POWER DISTANCE

There is general agreement between researchers that the structure of organisations impact on their ability to share knowledge and collaborate. In particular, Gold Malhotra and Segars (2001) observed that organisations with flexible, flat and organic structures are more likely to achieve benefits of knowledge sharing than companies that have hierarchical, bureaucratic structures.

Differences in the way decision making is executed due to the aforementioned structures are noted, where in small companies the reporting structure is more decentralised in SMEs than in larger companies. In the case of SMEs, one person such as the CEO, or owner may only be allowed to make strategic

decisions (Ghobadian and Gallear 1997, Nicolescu 2009). Given that decisions may be made in such a manner, SMEs may be at a disadvantage as the design of the reporting structure does not necessarily assure that good quality decisions are made. In addition, the CEO or owner may well be the main barrier to knowledge sharing.

In a similar manner to SMEs, Large companies may also be at a disadvantage as their formalised structures with standardised processes may break up, or fragment the decision making process (Ghobadian and Gallear 1997).

The distribution of power within networks can also affect the manner in which partnering companies collaborate. Cook et al. (1983) noted that the distribution of power may be brought about by the existence of a unique asset owned by one company to which other partners may become dependent.

In more recent research of SMEs participation in networks to enhance their capacity to innovate Jorgensen and Ulhoi (2010) observed that while SMEs were aware that some partners may have scarce technological know-how, they never felt that such power was being used to leverage their position. In addition, SMEs commented that through time the distribution of power is likely to change as knowledge and expertise is shared. Interestingly, SMEs also noted that the absence of formal contracts had made it easier to keep the distribution of power equal between partners. Similarly, Vanhaverbeke, Vermeersch and De Zutter (2012) have observed that SMEs are invariably in a position where they may have to put their faith in other partners' assurances particularly on high risk projects. Another form of dependency that may occur when for example a low tech SME engages in a partnership where they are dependent on the intellectual property (IP) of the other partner(s) when developing new products and processes together.

When investigating the influence of company size and culture, on the successful implementation of quality management programmes, Fai Pun and Jaggernath-Furlonge (2011) identified that low power distance had a significant positive effect for SMEs and no effect in the case of large companies. It is noted that low power

distance for this research referred to organisations characterised by flat decentralised hierarchies and empowered staff (Fai Pun and Jaggernath-Furlonge 2011).

2.3.2.3 UNCERTAINTY AVOIDANCE

In the main, small companies' ability to share knowledge is primarily related to their flexible, flat, organic structures and lack of resources. SMEs are known to have organic structures with processes which have a lower level of standardisation and loose and informal working practises. Large organisations, on the other hand have formalised structures that use both specialised and standardised processes (Ghobadian and Gallear 1997 and Nicolescu 2009).

A clear difference in resource levels in both types of company impacts on the manner in which change is identified and implemented. Ghobadian and Gallear (1997) noted that large companies generally have sufficient amount of resources to make reliable decisions related to organisational change. The lack of resource and more limited access to other companies may indeed make it harder for SMEs to read its market and therefore recognise the need for change (Ghobadian and Gallear 1997). The same authors did however note that opposition to change may just be as high in large companies. This may be due to in part, to the standardised working practices that personnel get used to over long periods of time.

The very nature of the working practices within the two types of company may also play a part in managing change. The flexible nature of SME's processes may indeed reduce the need to develop rigorous process and as such, operatives may not feel the need to record everything they do (Nicolescu 2009). Similar observations had been made by Tikakul and Thompson (2017) who observed that the biggest barrier to UK SMEs capturing, sharing and storing knowledge, was the lack of clear guidelines on the knowledge management approach that could be adopted and the lack of time to both share and store knowledge.

SMEs, may invariably collaborate with other companies who also operate within the same market as the SME and are therefore by definition competitors, a

scenario termed as ‘co-opetition’. When investigating co-opetition, Loebbecke and van Fenema (1998) have noted the effects of synergy and leverage of knowledge sharing between partners. The authors also note the extent to which the knowledge receiver’s use of the knowledge lowers the value of the sender’s original value thus termed ‘negative return impact’. When investigating the role of SMEs within co-opetition, Levy Loebbecke and Powell (2001) note that they invariably employ knowledge sharing tactics to mitigate the co-opetition forces evident within the partnerships they engage in. Whilst a number of cultural factors inhibit SMEs to operate effectively in such scenarios, their lack of clear guidelines and short-term orientation may impede their performance. Levy Loebbecke and Powell (2001) comment that SMEs need to be flexible and responsive to gain competitive advantage in scenarios that are ephemeral. SMEs are known to be flexible; however their working practices may result in them working without purpose in some situations. Levy, Loebbecke and Powell (2001) also note that SMEs are poor at recognising the value of knowledge and may often be ‘forced’ to share it to their larger counterparts. This may indicate that a small company’s short-term focus may also be a barrier in their ability to share knowledge in co-opetition. This observation is confirmed by Levy, Loebbecke and Powell (2001) who commented that SMEs lack of strategic focus coupled with poor use of information systems makes them poor at monitoring the performance of other companies. The authors also comment that SMEs are also poor at managing legal aspects of knowledge sharing.

2.3.2.4 MASCULINITY AND FEMININITY

Siakas and Georgiadou (2006) argued that the willingness to share knowledge is influenced by cultural factors from both the external and internal (organisational) environment. In their research, the authors observed that a Danish company had a predominantly feminine culture, which was characterised by high trust and co-operation which was considered as a basic value. In addition, Siakas and Georgiadou (2006) noted that there was no competition and all personnel seemed to ask for help and give help if asked for it. Given the aforementioned characteristics and personnel were empowered to make decisions, Siakas and Georgiadou also observed that a feminine culture also appeared to facilitate effective team working.

Organisations with feminine and masculine cultures may also feature some form of benefits to be realised from sharing knowledge. In this respect, Xu et al. (2005) identified in their research that this was considered by personnel in large companies, while small company participants did not consider this to be important.

When investigating the relationship between organisational culture and knowledge sharing Al-Alawi Al-Marzooqi and Mohammed (2007) view rewards as playing an important mechanism to share knowledge. The authors contended that it is not enough to rely on the good intensions of individuals without rewarding such behaviours. When considering varying types of reward systems (e.g. financial and non-financial), Al-Alawi Al-Marzooqi and Mohammed (2007) concluded that careful consideration should be given to the design of the system as it needs to fit the requirements of company personnel in a manner that will support their knowledge sharing behaviours.

Given the two types of culture, it is anticipated that organisations with masculine cultures may choose some form of material reward and feminine cultures choose nonmaterial reward.

Delerue and Lejuene (2011) investigated the impact of the institutional environment on the use of secrecy of intellectual property in biotechnology SMEs in 19 countries. The authors observed that SMEs with masculine, assertive cultures placed a higher importance of secrecy when managing intellectual property. Delerue and Lejuene (2011) noted however that their result contradicted a similar study conducted by Salter and Niswander (1995) who investigated the relationship between accounting data and Hostede's cultural factors, where a negative relationship was observed between secrecy and masculine culture. While the authors noted that the motive for secrecy may therefore be due to the nature of the data itself, this relationship may also be dependent on numerous other influential factors. For example, company executives may have unspoken protocols that they may follow and of course these may vary greatly both within and between companies.

When investigating the organisational cultural characteristics that influence knowledge management practices in small companies in Poland, Prystupa-Rządca (2017) identified that the companies exhibited feminine type cultures where personnel were cooperative and willing to share knowledge without receiving any benefits. The author noted that this finding was in stark contrast to general notion that Polish companies are typically characterised by masculine cultures (Hofstede 1980), which are driven by competition and knowledge is seen as a source of power (Morawski 2006).

2.3.2.5 LONG-TERM AND SHORT-TERM ORIENTATION

More recently Cherchione, Esposito, Spadaro (2015) found that high tech SMEs in Italy were overcoming their lack of human and financial resources and were able to take advantage of cheaper knowledge management systems to support knowledge sharing. While empirical evidence indicated that SMEs realised the strategic value of this by using a range of solutions in their companies. Cherchione, Esposito, Spadaro (2015) noted further that the systems that were being used were generally found to be out of date, some personnel were not receiving support from vendors and therefore not keeping abreast of technological change.

Lee et al. (2010) also noted that SMEs invariably have difficulty in selecting partners and in order to overcome this difficulty, the authors suggest that SMEs should use an intermediary organisation when working with partners to help them work towards a successful conclusion.

More recently when investigating the barriers to inter-organisational knowledge sharing in SME networks Meriläinen, Vuori, Helander (2017) found that some partners had not realised the value of a body of knowledge, which subsequently lead them to be unwilling to share it with other companies. Conversely, when a company acquired what it perceived as a valuable piece of knowledge it was not be able to utilise it as originally envisaged.

Durst and Wilhelm (2012) conducted research to investigate how SMEs cope with the danger of knowledge loss of an employee by doing some form of succession planning, which might involve interviewing the person leaving the company to get a grasp of their personal knowledge (theories-in-use). The authors found that all the companies they interviewed, were aware of the need to conduct some form of succession planning, however their operations were mainly focussed on delivering the current customer orders. As a result, the SMEs investigated were found to have a short-term focus which appeared to impede opportunities to conduct a form of succession planning to stop knowledge attrition.

2.3.2.6 INDULGENCE AND RESTRAINT

When considering the impact of SMEs' organisational culture on knowledge sharing, researchers' views are broadly in agreeance. Ghobadian and Gallear (1997) found in their study that SMEs were characterised by a unified culture which was found to be amenable to knowledge sharing. More recently, Slocinska and Depta (2015) found that knowledge sharing had a positive impact in SMEs due to the spontaneous behaviours of personnel, who worked together in close group relations. This was found to be in stark contrast to the knowledge sharing behaviours of large companies whose working practices were found to stimulate knowledge sharing to a lesser degree.

Given the lower number of employees in SMEs compared to larger companies, it is thought that SMEs' culture may well be beneficial to sharing knowledge as personnel may have greater oversight of each other's activities and more opportunities to develop working relationships. Nicolescu (2009) referred to this as the high human dimension, characterised by a high work ethic, good work climate and intense communication.

When investigating the knowledge sharing behaviours of micro, small, medium, and large companies Slocinka and Depta (2015) found in micro companies, that a high majority of personnel wanted knowledge that their co-workers possessed. The authors quite interestingly noted that this result was caused by the fact that

personnel watched their colleagues at work and wanted to gain knowledge of their practical problem solving skills.

In their research, Slocinka and Depta (2015) also found the larger the company, the greater personnel felt insecure. This finding is quite surprising as personnel in the large companies are known to have better employment stability. The high security exhibited by personnel in micro companies was developed through being able to improve existing processes in their own way and learn from their mistakes. This high security exhibited by personnel in the micro companies may well come from the intrinsic motivation that is developed through the transfer of knowledge seeking to knowledge contributing as confirmed by Yan and Davison (2013).

More recently research conducted by Strese et al (2018) who investigated the relationship between the SMEs CEO passion for inventing and the degree to which the company members shared the CEO's vision to produce the radical innovation. The authors noted that the CEOs' drive to generate innovative ideas and work hard inspired employees, which in turn spurred them on to buy in to realise the innovation outcomes. This research demonstrates the translation of a company's vision as realised by the SME's CEOs informed the organisational culture, which in turn informed and drove the radical innovations as realised by company personnel at the firm level.

2.3.3 PRACTICAL KNOWLEDGE

Practical knowledge is similar in nature to trust in that there are a broad number of views as to what it is. The reason for this is perhaps the vast number of areas in which practice theory has been developed. Most notable fields that have developed practice theory include philosophy (Bordieu 1990), economics (Dosi, Nelson and Winter 2002), sociology (Giddens 1982), management (Leonard and Swap 2005) and engineering (Pahl and Beitz 1988).

Whilst there are different views as to what practical knowledge is, there appears to be broad agreement that knowledge is composed of explicit and tacit knowledge as proposed by Polanyi (1962). Researchers who have used these

classifications include for example (Spender 1996; Blackler 1995; Snowden 2003 and Guzman 2009).

More specifically within the field of knowledge management, whilst conducting a literature review of knowledge theories and frameworks Heisig (2009) found that such initiatives covered the categories of human oriented factors, organisation, technology and management processes. More recently, when developing a taxonomy of knowledge management (KM) theory, Crane (2013) found that since the early 1990s theories have generally addressed knowledge at the organisational level, as social action and in a simplified (i.e. reductive) form. It is noted that the practice based theories and frameworks reviewed by the aforementioned author broadly sit under the same categories as stated previously with a smaller number focussing knowledge at the personal level.

Focussing on research that has considered knowledge as a social action at the organisational level Blackler (1995) noted that the common view of the organisation literature broadly identified with five dominant forms of knowledge work exhibited by four respective types of company as follows;

- Knowledge Routinised Organisations rely on knowledge embedded in technology, procedures and routines. (e.g. standard operating procedures used by production staff). (Tong and Mitra 2009).
- Expert Dependent Organisations mainly rely on knowledge embodied in competencies of key personnel. (e.g. know how used in problem solving used by operations staff to solve problems encountered in daily work). (Tong and Mitra 2009).
- Symbolic Analyst Organisations who mainly rely on key individual's skills and experience (enbrained knowledge). (e.g. design engineers' skills and abilities to produce product design solutions). (Tong and Mitra 2009).
- Communication Intensive Organisations who rely on encultured knowledge through collective understanding. (e.g. employees' shared perceptions towards teamwork). (Tong and Mitra 2009).

- Encoded Knowledge. Information conveyed from signs and symbols (e.g. software programs, data, records). (Tong and Mitra 2009).

Whilst Blackler (1995) outlines dominant types of knowledge work as being related to individual organisations, but later acknowledges that given the complex, multi-faceted nature of knowledge that it may be a mistake to assume that they all exist separate from each other. Tong and Mitra (2009) agree with this view and observe that these forms of knowledge may in reality coexist within the same organisation.

Blackler (1995) further noted the problem in characterising knowledge as it is constantly evolving and based on the aforementioned assumptions that knowledge should be viewed as knowing as an active process where it is mediated, situated, provisional, pragmatic and contested. In a bid to strengthen the practice based view by considering the relationship between practice and knowing through the concept of the 'site' Nicolini (2011) characterises organisational knowing as being processual, emergent, relational, place and time dependent, embodied, provisional, contestable and mediated through discursive exchange with materials and artefacts.

The trajectory of knowledge work in engineering practice in manufacturing would appear to broadly reflect the stages as outlined by Blackler (1995). Where initially in the early 1900s, factory operations were highly routinised around Taylor's system of tasks (Taylor 1911). It is here where no knowledge is added by the operator who is used purely as labour. This is a stark contrast to the lean manufacturing systems utilised by companies within Europe today where teams of operators and supervisors are typically responsible for workplace organisation (Imai 2012). Decision making tools and techniques such as 5S are used by organisations to promote productivity by simplifying the work environment, reduce costs, improve quality, reduce the number accidents and increase operator satisfaction (Peterson and Smith 1998). Wong and Wong (2011) note that this decision making tool engages the worker to observe a condition directly and formulate a solution. In finding a new solution the workers are encouraged by

their supervisor to discuss possible solutions in open forum with their colleagues thereby creating a learning environment.

Taking inspiration from the work of Guzman (2009) practical knowledge will be defined within the context of this research as *"knowledge related to a set of actions and associated behaviours undertaken by one or more persons, in order to achieve an outcome with, or without the use of artefacts."*

2.3.3.1 PRACTICAL KNOWLEDGE SHARING

The complexity of knowledge as practice (or knowing) as outlined by Blackler (1995) and Nicolini (2011) provides insight into the numerous ways in which practical knowledge can be constructed or shared.

Considering knowledge as dispositional, in a similar manner to Polyani (1966), Ryle (1954) distinguishes between '*know that*' and '*know-how*'. Brown and Duguid (1998) in turn consider these two components essential when considering knowledge as action. The authors note further that know that which is explicit knowledge may be shared by many personnel in an organisation and know-how, the ability to put know that into practice (Brown and Duguid 1998). As such, as know-how, which is a product of experience and tacit insight is embodied within practice is easy to protect and hence more difficult to share (Brown and Duguid 1999).

Cook and Brown (1999) on the other hand have argued that much research had been based on the view that knowledge had been something that one person possesses, which they term epistemology of possession, which focusses primarily on explicit knowledge at the individual level.

As a result, Cook and Brown (1999) call for an epistemology of practice, where explicit and tacit knowledge within individuals is considered to be static and acted upon generates knowing. The authors ascribe to the generation of organisational knowing from individual knowledge, where knowledge and knowing interact in a generative process called a 'generative dance'.

The most important aspect of the epistemology of practice as proposed by Cook and Brown (1999) is that knowledge and knowing are viewed as being mutually reinforcing in a manner where knowledge creation at the individual level is made available with instructions so they can be applied by groups of personnel. Tsoukas and Vladimirou (2001) also agree with this approach who outline that reflective practices should be recorded and this is done by recording the inferential rules guiding the respective practices. The aforementioned rules in turn inform the development of common principles and organisational (heuristic) knowledge.

Central to the two views of practice theory as proposed by Brown and Duguid (1998) and Cook and Brown (1999) is the generation of new knowledge by a social interactive process, which may be through various forms of work based learning at the individual and organisational levels. This review will consider theories that focus primarily at the individual level and then the organisational level second.

Notwithstanding the vast range of learning approaches that exist within the literature, some notable approaches to work based learning will be contrasted within the context of practiced based theory. This form of learning is considered as this plays a central role in organisation's practice based activities (Kolb 1984).

Eraut (2004a) refers to learning in the workplace as being informal, which can be implicit, reactive or deliberative and can be manifested in various organisational activities such as awareness and understanding, teamwork, decision making and problem solving.

Notable approaches to work based learning such as those proposed by for example Argyris and Schön (1974), Kolb (1984) and Raelin (1997) appear to be represented as a number of interacting processes or continuums composed of interactive activities, such as an initiation, action (practice) and reflection stages used as a means for learning.

In Kolb's (1984) four stage experiential learning model for example, immediate or concrete experiences provide the basis for observation and reflection at the individual level. These reflections are distilled into abstract concepts from which new implications are drawn and actively tested to form new experiences. This model adopts a dialectic approach to learning in two modes; grasping experience through concrete experience and abstract conceptualisation and transforming experience through reflective observation and active experimentation. Kolb and Kolb (2005) outline that their approach proposes a constructivist theory of learning where personal knowledge of the learner is constructed and reconstructed through social interaction. Kayes (2002) criticises this approach for not taking into account the relationship between personal knowledge and social knowledge. By adopting a poststructuralist analysis (Lacan 1977) to more precisely represent the transformational process loss (or schism) is created between an individual's personal need and what is expressed socially.

Such an approach is in stark contrast to other work based learning approaches such as that for example that proposed by Raelin (1997) whose proposes two models, at the individual level and group levels. Raelin's (1997) individual level model considers the creation of both explicit and tacit knowledge created in theoretical and practical learning modes. It is also noted that Raelin (1997) considers knowledge creation at the conceptualisation stage as opposed to Kolb (1984) whose view is that all learning is based on existing ideas (relearning). This notion has been confirmed by Muller et al. (2008) but has however shown that explicitly learning misconceptions does help to successfully learn the correct ones.

Reflection plays a critical role in practiced based learning to understand events and enhance meaning (Heyler 2015).

Whilst the models as proposed by Kolb (1984) and Raelin (1997) consider reflection as a specific phase as part of the learning process, others provide details of different types of reflection. Griffiths and Tann (1991) for example outline a five level model of reflective practice rapid reaction (immediate), repair (pause for thought), review (hours or days), research (weeks or months). In a

similar manner to Schön (1983, 1987) who proposed that reflective activities involve reflection in action and reflection on action. The former refers to the learner thinking whilst they are doing it. Due to its nature, learners may act based on their feelings and emotions and as they draw meaning to the scenario formulate a cause of action. Reflection on action is where an individual would review their actions with respect to the outcome(s) produced.

Theories of action and the double loop learning model as originally developed by Argyris and Schon (1974) provide specific insight into how reflective activities impact on individuals' knowledge sharing behaviours and hence implications for trust.

Argyris and Schön (1974) propose two contrasting theories of action, first those theories that relate to what individuals do in organisations, termed theories-in–use. The other being those theories that individuals talk about to colleagues termed espoused theories. Argyris (1980) notes that invariably there may be a disparity between the two items and therefore in organisations a key role for reflection would be to monitor the difference between these two items.

To operationalise the two theories of action, Argyris and Schon (1974) propose two types of learning; single loop learning and double loop learning. Single loop learning relates to the process of detecting and correcting errors through a process of trial and error. Double loop learning relates to questioning the choice of governing variables thereby undergoing some form of critical examination.

Figure 2 illustrates the single and double loop learning processes as proposed by Argyris (1999).

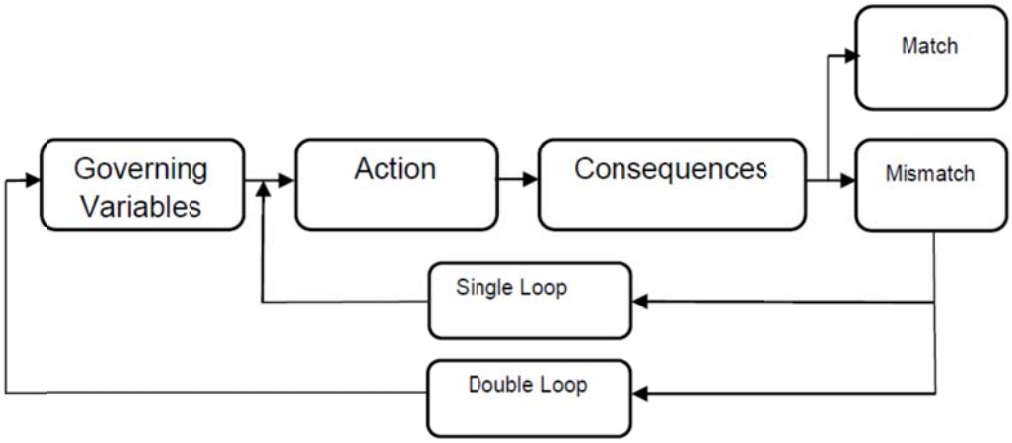


Figure 2: Single and Double Loop Learning Processes (Argyris 1999)

Whilst conducting empirical research related to both the learning processes Argyris and Schön (1974), observed the following behaviours:

- When learners look to minimise losses and capitalise on successes, it was noted that the individuals exhibited defensive behaviours, such as for example taking a myopic or unrealistic view on operational issues, or ignoring instructions from more senior personnel Argyris (1993).
- As learners operate in the aforementioned environment, for an extensive period of time, their behaviours and actions become the norm and promote productivity.
- Continued operation by the learner who maintains the same competencies appeared to reduce productivity.
- As learners reflected on their performance, they start to question their choice of governing variables with associated behaviours and actions, that is undertake double loop learning.

Since its inception, there has been some critics of this approach Greenwood (1993) commented that Schön's (1983) reflection-in-action and reflection on-action, implicitly undervalues what the author calls 'reflection-before-action' acknowledging that some time may have been invested in making some decision to undertake some form of learning in the first place.

Sun and Scott (2003) outline that the mechanisms to translate double loop learning from the individual level to the organisational level are not provided. The authors further add that for varying combinations of espoused theories and theories-in-use, no learning strategies are formulated to accommodate for it. For example, when an individual has tacit theories-in-use, this lends itself to single loop learning, however no instruction is provided on how to initiate double loop learning. When considering their assessment, Sun and Scott (2003) conclude that the mechanisms by which the learning processes are initiated are not provided.

Blackman Connelly and Henderson (2004) questioned the reliability of the double loop learning process in that mistakes may be created and as a result, interesting lines of inquiry may not be identified by learners.

It would therefore appear that most critics' concerns are related to double loop learning and the challenges it brings. It is however noted that Argyris (1999) conceded that double loop learning may be difficult to execute, particularly for inexperienced personnel, which in turn might impede achievement of objectives. Argyris (1999) also noted that achievement of objectives may not be achieved when there is a disparity between the learner's espoused and theories-in-use. This may be due to the tacit nature of some theories-in-use which may be difficult to interpret for learners.

Tunsi, Guzman and Shacklock (2012) have conceptualised a practical knowledge sharing framework taking inspiration from the work of Argyris and Schön (1974); Kolb (1984); Engeström (1987); Lave and Wenger (1991); Raelin (1997); Orlikowski (2002); Carlile and Rebentisch (2003); and Gherardi (2006).

Whilst reviewing the aforementioned work, Tunsi, Guzman and Shacklock (2012) note that each model does not provide explicit detail of what happens at each stage. Tunsi, Guzman and Shacklock (2012) also identify the need to investigate the use of suitable knowledge sharing mechanisms (e.g. face to face meetings and documentation) for certain types of practical knowledge. Boh (2007) and Guzman (2009) for example call for this to be investigated further as this aspect

has not been addressed by models formulated to date. Tunsi's, model of practical knowledge sharing does not however consider the influence of trust. For example, trust may influence the choice of mechanisms used for sharing different types of practical knowledge as indicated by Boh (2007) and Savolainen (2008).

Tunsi, Guzman and Shacklock (2012) comment on the important role of reflection and identify the inconsistent way in which it has been approached and propose that situation awareness in the manner proposed by Ensley (2006) should be considered when identifying suitable sharing mechanisms. It is also noted that reflective activities also provide an opportunity for an individual to consider the manner in which others are trusted with whom practical knowledge is shared.

In a similar manner to Cook and Brown (1999), Guzman's (2009) practice-based theory, which considers practical knowledge as being personal and situated in practice. Unlike Cook and Brown (1999), Guzman (2009) holds the view that the two knowledge states are not mutually reinforcing. The rationale for this is based on the view it is an individual user who interprets or translates for example, procedures before using them and therefore the method of application is formulated by the user based on their circumstances. As a result, practical knowledge according to Guzman (2009) is viewed as being personal, situated and constructed socially in tandem.

Based on the aforementioned practice-based theory, Guzman (2009) develops a taxonomy that is made up of four 'dimensions' of practical knowledge as shown in Figure 3.

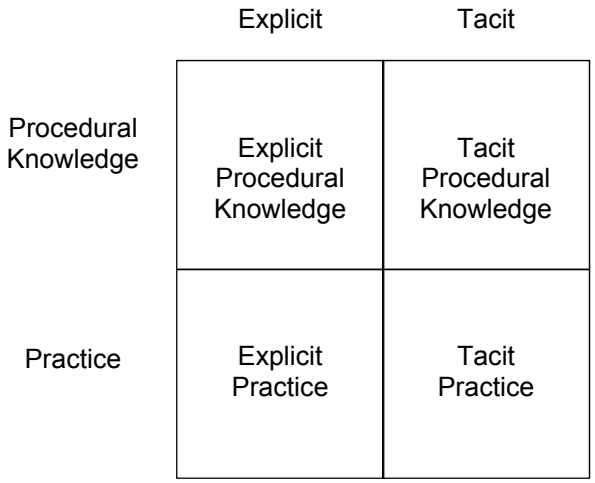


Figure 3 Taxonomy of Practical Knowledge
(Guzman 2009)

Guzman (2009) outlines that the four types of practical knowledge rather than being seen as distinct and individual, they should be viewed as part of a continuum. It is also noted that the four dimensions are viewed as different approaches to learning where practical knowledge is shared between individuals. As such, the taxonomy can be used as a framework, to identify the most suitable learning approach for a given type of practical knowledge.

It is noted from some authors, for example Crane (2013) that Guzman's (2009) practice-based theory has some weight due to its content validity. Since its inception the author has used the framework to identify how practical knowledge is shared between experienced and non-experienced workers of a company working in the bio-pharmaceutical industry sector (Guzman 2013).

Acknowledging that most studies of this type are usually undertaken in environments where people are collaborative, as a result Guzman (2013) choses to undertake research in what is termed a hostile environment where activities are undertaken in the context of significant social and political constraints. The study concluded that socialisation supported by political issues facilitated the sharing of practical knowledge and using standard processes for sharing practical knowledge was found to have limited application for complex tasks (Guzman 2013).

Whilst theories like those developed by Cook and Brown (1999) that address and link both the individual and organisational levels, there appears to be a growing body of practice based research that focus on groups and organisations in their own right.

One notable theory developed is that of Senge (1990) who proposes five disciplines are necessary to promote learning in organisations. These are personal mastery, mental models, shared vision, team learning, all of which are underpinned by systematic thinking, termed by some authors as systems thinking.

Whilst the five disciplines have received wide appraise and one of the few approaches that have acquired a place in the International Hall of Fame; Senge's (1990) theories have been the focus of wide criticism. Caldwell (2012) for example comments that the social practices of learning were not defined. Caldwell (2012) noted further that the constituent areas of practice, learning, agency and change are greatly incompatible. Whilst considering an improved approach based on systems based organisational learning as a process for organisational change, the author conceded that features such as organisational practices through which learning and change take place could not be theorized. In addition, Caldwell (2012) notes that the concept is flawed considering the ever increasing number and range of human actions in terms of for example, autonomy, and autonomy it would have to accommodate.

Fillion, Koffi and Booto (2015) broadly agree with the views of Caldwell (2012) and comment that in light of increasing economic change since the Senge's approach had been formulated; two additional features of knowledge generation and sharing and organisational behaviour should be added.

Practice based theory as developed by Raelin (1997) at the collective level considers Applied Science and Action Learning activities to promote explicit and tacit theories and Action Science and Communities of Practice as mechanisms to promote explicit and tacit practice.

All four areas are well established, the most notable being that of applied science where scientific knowledge are applied in the form of positivist methods, which are seen as being superior to scientists because of their adherence to objective approaches (Popper 1959). Action science is one area that is common to the approaches as proposed by Senge (1990) and Raelin (1997), where mental models in their various formats are developed and tested in practice.

It is noted that mental models have been used in a wide variety of fields; Davison and Blackman (2005) for example have used them to develop knowledge management systems in two diverse fields of cartography and healthcare. When applying the method, the authors noted that there was a tendency for some people (e.g. developers) to impose their models, thereby making the environment less uncertain, more manageable and therefore reduce the number of options to be considered. In response, Davison and Blackman (2005) outline that a team should acknowledge the uncertainty of the environment within which the system was being developed and consider the mental models put forward by all team members which may better meet the needs of all stakeholders.

Rather than learning by applying theory, action learning uses problems existing within the workplace as a focus for learning (Raelin 1997). As a result, action learning is learning by reflection that is underpinned by experiential learning. The most typical form of action learning is an apprenticeship scheme where learners undertake a specific programme of both off and on-the-job learning. Action learning as such commonly refers to a specific programme of learning (Raelin and LeBien (1993).

Critics of action learning such as Brook, Pedler and Burgoyne (2012) question what is meant by action, and note that action and therefore practice is not straight forward as it is dependent on the context within which it is taken. After considering a number of perspectives related to this issue, the authors concluded that an action that has an impact within the broader organisational setting matters.

Another consideration with action learning also appears to be who benefits the most from the initiative; the learner, the company or both. After conducting a literature review of fifty action learning projects in terms of learning (personal development) and organisational development, Cho and Egan (2009) observed that nineteen projects were considered to have an equal balance of learning (personal development) and organisational development. However it was also found that approximately half of the projects seemed to benefit the learner most. Upon concluding the review, Cho and Egan (2009) noted that one of the greatest challenges to action learning is achieving a balance between action and learning.

Communities of practice is probably one of the most prominent organisational practice based theories and is considered by Raelin (1997) as a mechanism to promote tacit practice in his work based learning model at the collective level. A community of practice is defined by Wenger and Snyder (2000) as *"groups of people, informally bound together by shared expertise and passion for a joint enterprise*".

Some of the key characteristics of communities of practice have been compiled from Wenger (1998) and Wenger and Snyder (2000) are as follows:

- Mutual relationships characterised by solidarity or disagreement.
- Shared ways of engaging together.
- Some members may develop a good understanding of other's members' capabilities and practices through knowledge exchange.
- Shared stories and jokes.
- A shared discourse related to specific subject matter.
- Unique ways and styles of communicating (e.g. use of acronyms and jargon).
- The members are held together through passion, commitment and identification with the expertise of the group.

In addition to the above, Lave and Wenger (1991) provide further insight into the dynamics of knowledge flows of communities of practice where learning is viewed as situated in which they characterise it as a process of legitimate peripheral participation. Taking a social perspective, Lave and Wenger characterise

learning as a process of peripheral participation where the learner develops understanding of the social relations of the community and gains access to mature practice, which they apply, assess and gain recognition for through their own contributions. Through time, the learner moves progressively towards being fully engaged in what is termed 'sociocultural practice' where the learner gains recognition as a practitioner (Lave and Wenger 1991).

Brown and Duguid (1991) consider situated learning as proposed by Lave and Wenger (1991) in the same way conventional learning is delivered and outline much of the knowledge learned is abstract in nature.

Considering the work of Orr (1996), an ethnographic study observing groups of photocopy technicians at work, Brown and Duguid (1991) identify two forms of practice Canonical and Non-Canonical in the way they worked. Canonical practice relates to the way organisations thinly describe how work is done in, for example company procedures non-canonical practice relates to actual practices (theories-in-use) that workers use to solve problems (Brown and Duguid 1991).

When considering these two theories, Brown and Duguid (1991) argue that learning in the manner as proposed by Lave and Wenger (1990) should be viewed as a bridge from working to innovating. Where the change brought within a community provides a focus to understand how work and learning take place together.

The view as proposed by Brown and Duguid (1991) of the relationship between work and learning in communities has merits, however it is believed that the relationship may be more complex where the two may work together in an interdependent manner prior to innovations being realised.

Given the characteristics of communities of practice as noted previously; the very same characteristics such as shared perspectives and mutual relationships, Wenger McDermott and Snyder (2002) note that these very characteristics could also hold it hostage to its accomplishments.

Roberts (2006) observed a number of difficulties related to power, trust and predisposition that affect the way communities of practice operate. In addition, Roberts (2006) noted that the power dynamic influences the way knowledge is created and disseminated given that personnel of various standing may exist within a community. This may impact the degree to which certain members participate and therefore some peripheral members may not develop beyond this position. This scenario would be consistent with the view of Brown and Duguid (1991) who commented that some community members may only acquire abstract knowledge.

The power structure of an organisation may also be reflected in the relationships developed within a community (Roberts 2006). For example in a centralised organisational network, the power structure may be centralised and hence knowledge flows may only be evident to a small number of individuals in a company.

Roberts (2006) has noted further that the existence of trust between members enables them to develop a mutual understanding based on shared social and cultural backgrounds. Therefore without trust, members of a community of practice may not be willing to share knowledge.

As noted previously, that power influences social interaction, and perceptions between members will in turn influence the degree of trust between members who are sharing knowledge (Roberts 2000). This may certainly be the case in the centralised organisational network scenario outlined previously where only a smaller number of members engage with each other, which may be on a smaller number of topics of interest to themselves.

The existence of habitus (Bourdieu 1990) within communities of practice invariably makes them predisposed to the absorption and creation of certain types of knowledge (Robert 2006). Brown and Duguid (1998) outline that the dispositional knowledge of communities of practice is viewed as a social property, characterised by extensive know-that and collective know-how. One of the biggest problems with its dispositional nature is that some communities may

become static in its terms of reference or scope. This may be due to its willingness to adopt knowledge that is more closely aligned with the interests of its members (Roberts 2006).

Recognising that most research on communities of practice (CoP) had focussed on large companies Pattinson and Preece (2014) investigated the use of communities of practice in science based SMEs. In this research, the authors identified three types of communities as follows:

- Apprentice based CoP for individual learning.
- Intra-organisational based CoPs for knowledge sharing between professional groups (i.e. scientists and engineers).
- CoPs that emerge between external organisations such as customers and local universities.

It is noted further from this research that Pattison and Preece (2014) observed that some SMEs did not recognise the existence of the communities or even the benefits that such an initiative brought.

When reviewing the literature on discord between organisational and practice based theories of knowledge intensive organisations, Burford et al (2011) outline that initiatives like communities of practice appear to be an attempt to align emergent practice at the tactical level with that formulated at a strategic level.

In concluding their research, Burford et al. (2011) outline that the two initiatives will never fully support an organisation's knowledge agenda and as a result suggest that a fluid and integral perspective should be taken where the two aspects are negotiated with regards core aspects of an organisations business.

In general terms, academic research on practical knowledge has acknowledged the importance of trust both indirectly and directly. For example, Argyris (1976) asserts that double loop learning is based on shared, bilateral control, which is based on sharing personal views in order to problem solve. Quite clearly in order

to do this, trust is required to be exercised by all personnel involved. Orlikowski (2002) acknowledges that socialisation processes to build trust, credibility and respect are key to the sharing of practical knowledge. Despite the important role of trust in the sharing of practical knowledge as indicated, this area has not been addressed by academic research.

2.3.4 TACIT KNOWLEDGE

The literature in general attests to the importance of tacit knowledge in contributing towards a company's competitive advantage. Grant (1996) for example has argued that tacit knowledge is one of the most critical resources of a company. This view of tacit knowledge as a resource is justified in that while competitors can purchase various types of resource, the best type is a form of resource like tacit knowledge that is unique and cannot easily be transferred. As a result, Grant (1996) views tacit knowledge as one of the most important organisational resources from a strategic perspective.

The concept of tacit knowledge was founded by Michael Polyani (Polyani 1958) who investigated weaknesses in the scientific method with the aim of demonstrating that precise objectivity as portrayed by the method was a false notion. In studying personal knowledge in scientific research, whilst observing the important role of language in sharing knowledge, he observed that people can do things in a manner without knowing and not being able to articulate their actions (Polyani 1958).

Further work by Polyani (1966) gave way to the famous quote, which many people use to provide insight into the nature of tacit knowledge *"I shall consider human knowledge, by starting from the fact that we can know more than we can tell".*

Therefore from Polyani's work comes the notion of explicit and tacit knowledge where he observes within his work as *"the process by which the tacit cooperates with the explicit"* (Polyani 1958). It is however interesting to note that for Polyani (1958), all knowledge has a tacit component. Therefore the precise conversion or translation of tacit knowledge cannot be made to explicit knowledge, but rather

be made more explicit under certain situations (Grant 2007). As a result, Polyani (1958) characterises tacit knowledge as being something personal, where for example experience and learning is applied to solve a problem.

In the broader literature, Nonaka (1991) characterises tacit knowledge as knowledge that is difficult to write down and hence formalise.

Sternberg (1994) like Polyani, views tacit knowledge as context specific, where the knowledge is obtained through the role where it was originally used. Nonaka (1991) outlines that tacit knowledge is personal knowledge where it has a cognitive aspect and consists of mental models that individuals follow. Ravetz (1971) noted that tacit knowledge may also become engrained within people to such an extent that it becomes an integral part of the way they go about their daily work.

Like Brown and Duguid (1999), Nonaka (1991) views tacit knowledge similar to know how and even comments that it can be defined as *"a synonym for tacit knowledge"* as it is similar to the skills that are acquired by individuals through experience.

Ambrosini and Bowman (2001) appear to agree that tacit knowledge is somewhat similar to know how, however they take the view that the term 'tacit knowledge' as contradictory as the word 'tacit' implies subjectivity, and 'knowledge' refers to a level of objectivity. As a result, the authors use the term 'tacit skills' in their work. Taking inspiration from the work of Berry (1987), Ambrosini and Bowman (2001) introduce the notion of levels of tacitness, which are illustrated in Figure 4.

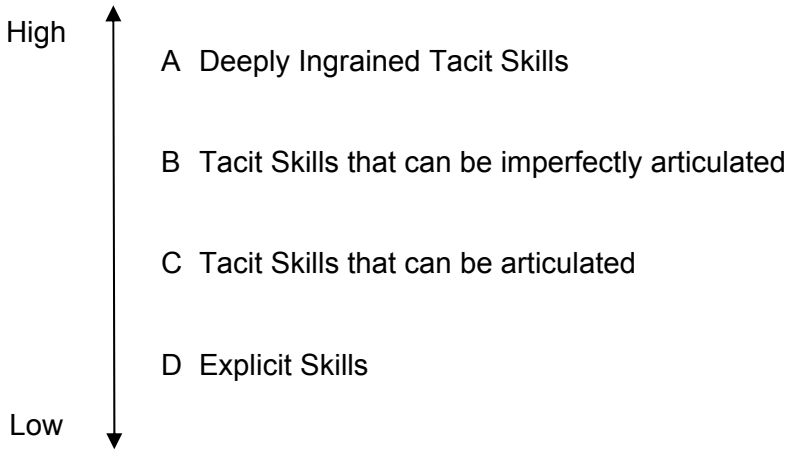


Figure 4: Degrees of Tacitness (Ambrosini and Bowman 2001)

At the two opposite ends of the tacit 'spectrum' there is deeply ingrained tacit skills and explicit skills that are in a codified format and can be shared. The two intermediate points take inspiration from the work of Berry (1987) on expert knowledge. These relate to skills that are unarticulated, but could be articulated if asked 'how do you do that'. As a result, such skills could be classed as personal in nature but become tacit through time. The other level of tacitness relates to skills that cannot readily be expressed in words but could be articulated through the use of analogies, metaphors or stories (Ambrosini and Bowman 2001).

Levels of tacitness A to D as defined by Ambrosini and Bowman (2001) seem to agree with the view of Polyani (1962) in that they appear to have a tacit component. In the case of explicit skills, the authors do not acknowledge the existence of a tacit component stating purely that sharing this type of skill could be 'easily' shared or communicated. As a result, at this level, it is thought that even explicit skills may have some tacit component.

When formulating a strategy to elicit tacit skills within their research, Ambrosini and Bowman (2001) acknowledge that trying to capture tacit skills that are deeply ingrained may not be a realistic endeavour. As a result, the authors outline that eliciting unarticulated tacit skills at levels B and C may be achieved through asking the right questions or expressed through other means.

One theory by Nonaka (1991, 1994) has been the knowledge creation firm, which proposes the SECI Model, while being influential has also been the focus of much debate around how the author interprets Polyani's views on tacit knowledge. Some of the appraisals of Nonaka theory will be considered as it believed that this will further help to understand the nature of tacit knowledge.

The SECI model describes knowledge creation at the organisational level as dynamic, spiralling processes of socialisation, externalisation (explicit knowledge), combination and internalisation (tacit knowledge). Through the model, it is claimed that tacit knowledge can be translated to explicit knowledge and promoted in the environment of what is termed 'Ba' (Nonaka and Konno 1998). Since its inception, Nonaka's Knowledge Creation theory has received some criticism by various researchers.

Some authors critique Nonaka's theory for the perspective it takes. Virtanen (2011) for example claimed that Nonaka's theory appears to devalue tacit knowledge and overstates the utility of explicit knowledge. Grant (1996) criticises the approach for taking an organisational perspective, which provides guidance in the form of rules, and procedures but not mechanisms, which are used by individuals.

Given that the knowledge creation theory claims to draw from the work of Polyani, is problematic as it is widely considered that Nonaka's theory has misinterpreted Polyani's work on tacit knowledge (Gourlay 2006; Grant 2007; and Virtanen 2011). This misinterpretation is identified from Nonaka (1994) who outlined that knowledge can be defined as explicit or codified knowledge that can be translated, and tacit knowledge, which is more personal and therefore more difficult to translate. Clearly, this is different to that of Polyani (1962) who posited that all knowledge is personal and has a tacit, contextual component and is therefore impossible to understand.

Crane (2013) noted some further disparities between Nonaka and Polyani's theories from a temporal and cognitive perspective. Nonaka (1994) outlined that explicit knowledge refers to past events and tacit knowledge refers to future

events, and only tacit knowledge is composed of psychological items. While a large proportion of tacit knowledge may be 'internalised', Crane (2013) observed that the tacit element could be related to the past or the future. In addition, as Polyani (1962) outlined that all knowledge has a tacit component, then it would not be logical to assume that explicit knowledge has no cognitive elements to it (Crane 2013).

Many authors appear to criticise Nonaka's knowledge creation approach for over simplifying the nature of tacit knowledge and the way it is conceived. Blackler (1995) for example, described the theory as taking a reductionist approach, thereby simplifying the knowledge creation process. Similarly, Tsoukas (2011) outlined that the approach has impoverished the concept of practical knowledge as it takes tacit knowledge embedded in an individual's head and accurately define it as explicit knowledge.

Thompson and Walsham (2004) are critical of the SECI model for viewing knowledge as objects that pass through various stages and comment that this leads to a contradiction as knowledge is highly relational and therefore does not transfer to other forms, which can be utilised by a company.

Some researchers have noted that the adoption of Nonaka's theory has had adverse implications for practitioners within the field of knowledge management. Grant (2007) for example, has claimed that many people within the field of knowledge management, (KM) while acknowledging the work of Polayni, have adopted a similar positon to Nonaka (1991 1994), which has been one of the main underlying reasons why many KM initiatives have failed. This view has been supported by Virtanen (2011) who conducted a review of the literature on KM systems and noted that most systems that have been designed with the aim of translating tacit knowledge to explicit knowledge had been unsuccessful.

It would therefore appear that the main criticism of Nonaka's knowledge creation theory is in the interpretation of tacit knowledge and its translation to explicit knowledge (Tsoukas 2011). Depres and Chauvel (2002) agree with this view in outlining that the knowledge creation theory appears to have treated knowledge

as objects and decontextualised tacit knowledge, thereby rendering it meaningless.

2.3.4.1 SHARING OF TACIT KNOWLEDGE

Since the work of Polyani, there has been a number of practice based theories at both the individual and organisational levels that have been developed and embrace the view of Polyani (1958, 1966). By comparing and contrasting tacit knowledge within the contexts of different example practice based theories it can be seen how tacit knowledge is shared.

Taking Polyani's view on tacit knowledge, Tsoukas (2011) opposed what he calls the modern movement towards the decontextualisation of tacit knowledge and argues for a phenomenological perspective to be taken to how tacit knowledge is conceptualised at the individual level. In doing so Tsoukas (2011) takes the perspective of the knower and the importance of the experience and skills that the knower brings to the practice they engage in. As such, the author argues that tacit knowledge is always contextual and therefore related to action. Given this view, Tsoukas (2011) calls on researchers to move away from thinking about converting tacit to explicit knowledge, but articulating it as dialogical interactions.

In a similar manner to Tsoukas (2011), Linde (2001) views narrative from individuals as a form of tacit knowledge, termed as social knowledge. Narrative is also viewed as a mechanism that bridges explicit and tacit components allowing tacit social knowledge to be demonstrated and learned. Linde (2001) observed that many organisations go to lengths to record individual stories in for example lessons learned databases; many of the records were not useful, as the knowledge is recorded in a format that is of no use to the organisation as a whole.

Taking the same view as Polyani, with regard the explicit/tacit knowledge distinction, Cook and Brown (1999) take the view that individuals and groups do knowledge (epistemic) work that the other cannot. For example, photocopier technicians may know certain sounds a photocopier makes when it is not working properly and groups of technicians are aware of stories of the certain sounds that

photocopiers make. The distinction here is that while individuals possess various specific pieces of knowledge, a group would possess a body of knowledge, where knowledge is based on common understanding (Cook and Brown 1999). As a result, Cook and Brown note that the work done by the individual and group can be viewed as being epistemically distinct.

Building on the aforementioned understanding of individual/group knowledge work, Cook and Brown (1999) observed that the explicit forms of knowledge that are shared between individual group members may be stories about successes or failures. The tacit form of knowledge possessed by groups is defined by Cook and Brown (1999) as 'genres', which are terms, that a group might attach to various practices such as discussion topics and different forms of activities undertaken. It is important to note that such 'genres' emerge and develop through time as the group's practices develop.

Leonard and Sensiper (1998) comment that collective tacit knowledge may develop communally over time and reside in the heads of senior group members that have been fully socialised in the full breadth of a group's practices. The authors also note one major advantage to developing such an approach in that when personnel leave a company a 'shared net of expectations' are created by the working practices that were introduced by a group.

One barrier to sharing tacit knowledge may exist in highly innovative companies where for example specialists are encouraged to hoard their knowledge, the benefits of sharing tacit knowledge will not be realised. This may particularly be the case in companies where expertise in specific fields are highly regarded and even rewarded and as a consequence, initiatives such as mentoring schemes are seen as a waste of valuable time (Leonard and Sensiper 1998). Another barrier to sharing tacit knowledge outlined that distance (in terms of physical distance and time) may make the sharing of tacit knowledge more difficult and while sharing knowledge by digital means may be partial solution as such knowledge is best shared most effectively through body language and the demonstration of skill (Leonard and Sensiper 1998). Knowledge hoarding and distance were also

two barriers to the sharing of tacit knowledge identified by Olaniran (2017) in more recent research

Research has also highlighted the important role of trust in bringing about the necessary conditions for sharing of tacit knowledge. When investigating the sharing of tacit knowledge in project based organisations, Savolainen (2008) for example found that trust played an important role in facilitating the development of an open workplace culture where relationships were allowed to develop between group members. This form of culture characterised by open communication was found to promote the sharing of tacit knowledge.

The forms of tacit knowledge shared between group members identified by Savolainen (2008) were mental models, intuition, interpretations, professional abilities and skills. Tacit knowledge sharing methods identified by the same author were social interaction, modelling, mentoring, action learning, narratives, collaboration, or 'just doing' (Savolainen 2008).

Research has also demonstrated how different forms of trust affect knowledge sharing behaviours. Zhang (2014) for example found that affective trust increased knowledge sharing and alone facilitated the sharing of explicit knowledge. In addition, cognitive trust was important in knowledge seeking and adoption. Interestingly, the author commented that effective sharing of tacit knowledge requires the simultaneous application of both affective and cognitive trust. This finding agrees with similar earlier research conducted by Holste and Fields (2010) who found that affect-based trust had a significantly greater effect on the willingness to share tacit knowledge, whilst cognitive-based trust was found to have a greater role in the willingness to use tacit knowledge.

Nelson (2016) observed that researchers are often faced with the dilemma of having to consider whether to share or not share valuable knowledge and therefore formulate strategies that enables them to maximise their own interests. When investigating sharer/secrecy tensions of university and private companies in the biotechnology and digital audio sectors Nelson (2016) observed that

researchers broadly adopt four strategies; leveraging trust; strategic withholding; delaying and patenting.

Focussing on the leveraging trust strategy, it was observed by Nelson (2016) that companies leveraged trust through conducting practical (hands-on) training with partners and through informal dialogue. As a result, it was noted that trust was based on the development of personal relationships. Conversely, it was observed that trust played a small role when managing sharing strategies that reached beyond their personal networks. This finding appears to show that collaborative relationships are best developed at an inter-personal level, which facilitates the sharing of tacit knowledge and also agrees with findings of the research conducted by Holste and Fields (2010) and Zhang (2014) as outlined earlier.

In addition to the above findings, the audio researchers who operated in a smaller sector, personal networks appeared to account for a large proportion of the field. In light of this observation, Nelson (2016) suggest that organisations that work in small industry sectors may leverage trust of partners more than organisations who work in larger sectors.

The sharing of tacit knowledge may well involve certain levels of risk and uncertainty, which may be reduced by trusting relationships being formed (Foos, Schum and Rothenburg 2006). In addition to trust, Cloonan, Matheus and Sellini (2008) observe that power exercised by one company may well have either a positive or negative impact on both trust between two companies who engage in knowledge sharing activities.

2.3.5 SUMMARY OF FINDINGS FOR KNOWLEDGE SHARING

Summary of the findings from this sub-section are as follows:

- Extensive research has been undertaken to identify the factors that influence the sharing of knowledge. The most notable factors relevant to this research identified by Ipe (2003) and Rehman et al. (2011) include company size and structure, culture and climate of work environment, knowledge type, motivation, opportunities to share, rewards, stressors and job type.

- The knowledge sharing culture of technology producing SMEs has been characterised by considering the promoters and inhibitors of knowledge sharing in terms of the cultural dimensions as proposed by Hofstede (1984) and Hofstede, Hofstede and Minkov (2010).
- SMEs appear to exhibit a low power distance due to their flat, flexible structures which may enable them to share knowledge effectively and efficiently. Collectivism is also more evident in SMEs, which promotes greater awareness of the skills of personnel and in turn make them more adept at understanding their core competencies. SMEs may however be at a disadvantage in that they generally are known to have a lower uncertainty avoidance where for example some SMEs may engage in arm's-length relationships where neither partner are willing to take risks. The short-term orientation of SMEs may also hinder their ability to exploit new knowledge effectively due to not knowing the value of key or important pieces of knowledge.
- The conceptual foundations of practical knowledge have been discussed by considering a number of practice based theories of sharing activities at the individual and collective or group levels. One most notable piece of work identified is that of single and double loop learning as originally formulated by Argyris (1999), which provides key insight into how trust may be considered when sharing practical knowledge.
- Building on the work of a number of researchers, Tunsi, Guzman and Shacklock (2012) have conceptualised a practical knowledge sharing framework. This framework has provided insight into how the single and double loop learning model as conceptualised by Argyris (1999) can be used as a foundation for considering how practical knowledge is shared. It is noted however that this approach does not specifically consider the role of trust.
- One other notable model or taxonomy of practical knowledge as formulated by Guzman (2009) has also been identified by researchers such as Crane (2013) due to its content validity and multi-dimensional view of practical knowledge.

- The topic of tacit knowledge is probably the most contentious in that there appears to be a significant amount of disagreement as to what it is. Many researchers appear to ascribe to the views of Polyani (1958, 1962) who originally conceptualised the notion of explicit and tacit knowledge. In doing so, Polyani holds the view that tacit knowledge cannot be made explicit, but rather more explicit.
- Acknowledging the difficulty in defining tacit knowledge, Ambrosini and Bowman (2001) propose a scale of tacit knowledge that enables researchers to define tacit knowledge in a practical manner, whilst acknowledging its imperfections.
- The sharing of tacit knowledge has been identified as one area that has received a lot of attention more recently by researchers, however research that has specifically considered the sharing of tacit knowledge and trust was found to be limited. Notable research in this area is that of Holste and Fields (2010) who identified that affective trust had a greater effect on the willingness to share tacit knowledge and cognitive trust had a greater role in the willingness to use tacit knowledge.

2.4 COLLABORATIVE RELATIONSHIPS

In this sub-section collaborative relationships is considered with a view to establishing how trust develops in specific phases, typically over the life cycle of a project. Theory that has considered how trust based collaborative relationships develop in SMEs is then reviewed. Research that conceptualises trust development in collaborative relationship phases are then contrasted with a view to proposing relationship phases that can be used in this research.

For each relationship phase that will be adopted in this investigation, research that has focussed on specific aspects of trust development are then reviewed to identify theory that exists from a general (large company) and SME perspective.

2.4.1 TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

Having established what some of the key characteristics of trust based relationships are, the manner in which trust develops during the life of a

relationship has also been investigated by trust researchers. Lewicki and Bunker (1996) for example have formulated a model, which outlines how inter-personal trust develops, over the course of time in a working relationship. Lewicki and Bunker's (1996) model is composed of three trust levels, which form a sequence where trust has be developed at one level before moving on to the next. The levels or paradigms are as follows:

- Calculus (decision) based trust
- Knowledge-based trust
- Identification (behavioural) based trust

The types of trust within the Lewicki and Bunker's model specifically outline how a working relationship changes through time, where trust is initially based on calculative decisions, then judgements based on knowledge about the other partner, and finally making trust perceptions based on the other partner's behaviours (Lewicki and Bunker 1996).

It is noted that knowledge based trust as originally proposed by Shapiro, Sheppard and Cheraskin (1992) is trust based on the ability to accurately predict the behaviours of the trustee based on prior knowledge on performance. Similarly, cognitive trust is a rational decision based on whether a trustee fulfils their role (Lewis and Weigert 1985, Mc Aliister 1995). As such, this form of trust is based on predictions of previous knowledge on how well a trustee lives up to their agreed obligations. When comparing the definitions of the two types of trust it can be seen that knowledge based trust is marginally different in that it is based on accurately predicting the trustee's behaviour.

Schilke and Cook (2013) develop a conceptual model on how trust develops at both the individual (inter-personal) and organisational (inter-organisational) levels.

Shilke and Cook consider trust development between boundary spanners, such as project managers who typically have a coordinating or monitoring function which requires them to communicate frequently with collaborating companies

(Tushman 1977, Currall and Inkpen 2003). Table 6 outlines the typical activities between two boundary spanning agents (individual A and B) who represent organisation A and B respectively.

Relationship Stage:	Initiation	Negotiation	Formation	Operation	Feedback
Trust Development Stage:	Individual A to Organisation B	Individual A to Individual B	Individual A to Organisation B	Organisation A to Organisation B	Organisation B to Organisation A
Typical activities	Gathering clues about Trustworthiness about partner	Negotiation through interpersonal interaction	Transference of trust from individual to organisation	Institutionalisation of Trust between companies.	Feedback at Organisation levels

Table 6 Process Model of Cross-Level Trust Development in Inter-Organisational Relationships

(Schilke and Cook 2013)

Unique aspects of this model relate to the transference of trust at the formation and operation stages. Common to both stages is the concept of trust transfer where it is posited that trust can be transferred to another party (a third party) who might not necessarily have direct experience with a trusted individual (Strub and Priest 1978). The third party may then assume the role of a proxy (or trustor) who may then transfer trust on to another individual (Shaprio 1987; Krackhardt 1992). This cycle of trust transfer may then continue through a broader number of individuals.

In a similar manner, Zucker (1986) has observed that third party trust transfer can take place in situations where one company representative may act as a third party intermediary who may broker trust with another organisation (or trustee).

At the operation stage of the process model trust is institutionalised, where personnel within one partner organisation work together to establish mutual understanding and common decision making behaviours so that colleagues can work together effectively (Tolbert and Zucker 1996). This characteristic of the process model concurs with one of notable features of trust based relationships outlined previously.

Whilst initially it may seem that the two mechanisms of third party trust transfer and establishment of mutual understanding may be effective ways of developing trust, cultural barriers may impede its promotion in both instances. Trust researchers such as Nooteboom, Berger, Noorderhaven (1997) have acknowledged that trust perceptions may be affected by values and norms, which are taken to be part of an institutional environment, and are likely to differ between individuals and organisations.

Both Shilke and Cook's (2013) model and its associated characteristics highlight that both trust at the interpersonal and organisational levels are distinctly different. As a result, it can be said that isomorphism does not exist in trust as a concept. Isomorphism is a general term used by scholars in numerous fields,

which refers to the structure of a construct that is said to be the same at all levels (Rousseau and House 1994).

2.4.1.1 TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS OF SMEs

Whilst the role of trust in general terms in relationships has been investigated by researchers, a detailed treatment of trust building and its interaction with associated practical knowledge types has received limited attention. Two studies, that investigate the aforementioned phenomena within an SME context, are outlined by research conducted by Dowell, Heffernan and Morrison (2013) and Hardwick, Anderson and Cruickshank (2013).

Trust development in business to business relationships of both small and large companies' marketing function is outlined by Dowell, Heffernan and Morrison (2013). The authors' study focusses on the relationship growth stage and identifies the factors that develop three trust dimensions. For ability trust, the most important factors for its development were expertise, communication and performance. For integrity trust, honesty integral actions and candid responses were found to influence the development of trust. For the benevolence dimension, trust actions and attitudes influenced the development of trust.

Hardwick, Anderson and Cruickshank (2013) investigated the development of trust formation processes of entrepreneurs in small bio-tech companies in face to face and virtual networks. Based on a qualitative study approach using participant observation and semi-structured interviews, the authors identified two approaches to trust building; technical and social, which were found to be used together in combination and produce complementary types of trust.

The ability and benevolence trust types and associated actions identified by Dowell, Heffernan and Morrison (2013) broadly agree with the technical and social trust approaches identified by Hardwick, Anderson and Cruickshank (2013). It is however implied within the trust patterns observed by the aforementioned authors that integrity facilitates the development of personal trust. Barnard Schurink and De Beer (2008) observed that integrity has both

cognitive and affective components which relate to a person's ability and self-regard. In terms of trust development, it is noted that integrity may therefore act as a bridge between ability (technical) phase and benevolence (social) phases.

In the research conducted by Hardwick, Anderson and Cruickshank (2013) it is noted that whilst the dominant dimensions of trust at various stages of project collaboration with operational mechanisms were identified, no detailed analysis was conducted of the relationships between the trust elements, types of knowledge and the operational mechanisms employed. In addition, the application is in bio-tech SMEs and not engineering based SMEs.

One other example of trust development not conducted in SMEs by Van der Werff and Buckley (2014) is worth noting, as it is thought that the trust patterns observed may be adopted by SMEs as they invariably do not have the time to engage in developing trust based collaborative relationships (Brunetto and Farr-Wharton 2007) to facilitate growth (Möller, Rajala, and Svahn 2005).

In a four-wave longitudinal study of trust behaviours in one consultancy organisation, Van der Werff and Buckley (2014) analyse trust cues of new employees. The concept of trust cues was originally developed by Kramer and Lewicki (2010), who observed that cues are exhibited by individuals in a given scenario that 'prime' the decision to trust. Based on theoretical work, Kramer and Lewicki outlined that presumptive trust cues during an ongoing process of socialisation, where perceptions are based on rules that are ingrained in the company environment (rule based trust) roles of colleagues (role based trust), and identification with the trustee(s). As such, presumptive trust cues are initially thought to be used by trustors when they have little knowledge about the trustee (Kramer and Lewicki (2010).

Based on the work of Kramer and Lewicki (2010), and Mayer, Davis and Schoorman (1995); Ven der Werff and Buckley (2014) introduce the notion of personal trust cues based on the trust antecedents of competence (ability), integrity and benevolence and distinguish these from presumptive trust cues.

Drawing further insight into trends of trust development from McKnight and Chervany (2006), Van der Werff and Buckley (2014) hypothesize that presumptive trust cues are used first, which may diminish over the course of a relationship and be replaced by the use of personal cues.

Using questionnaires, which were administered at four time points, Van der and Buckley collated data pertaining to presumptive trust cues, personal trust cues and trust propensity.

The most notable finding from this research was that it did not see evidence of a shift from presumptive to personal trust cues over time where personal trust behaviours were evident at the start of the time period of the study. In response to this Van der Werff and Buckley (2014) noted that this indicated that participants were making trustworthiness evaluations as soon as people meet with existing company personnel.

At face value this finding appears to show that participants were exercising a form of *'swift trust'* where the professional competence of others is presumed and some trust development phases are bypassed (Meyerson, Wick, and Kramer 1996). It is however noted that the participants were new, inexperienced trainees and as such this also may explain the absence of a calculus based trust phase and the dominant trust cue pairs observed. New employee's knowledge of company rules and roles may indeed be vague and would develop as they interact with existing company personnel (Rousseau 2001). It is noted further by Kramer (1999) that rule based trust can only be formed when a common understanding has been formulated of an organisation's rules and procedures.

It is noted that the social approach to trust development patterns as observed in the research conducted by Hardwick, Anderson and Cruickshank (2013) and the affective trust (or Swift Trust) approach as observed by Van der Werff and Buckley (2014) are similar where partners develop personal bonds early in the relationship.

It should also be noted that the affective trust building approach as observed in the two aforementioned research initiatives are also evident in the Guanxi networks usually found in China (Lee and Dawes 2005). Chua and Morris (2006) observed that whilst both instrumental (ability) trust and affective (benevolence) trust were evident in relationships in Western (American) and Chinese relationships, the main defining characteristic was that the latter were based on affective trust, whilst the former were based on ability trust. This distinction may be grounded in the culture of the two countries where Chinese people have an interdependent construal of self, whilst Western people tend to have an independent construal of self (Markus and Kitiyama 1991).

2.4.2 PHASES OF COLLABORATION

The purpose of this sub-section is to review a number of different approaches that have considered how working relationships develop over a course of time, typically over a life of a project. The aim of this exercise is to identify a suitable classification or taxonomy and specific activities that can be used as a medium within which to investigate how trust influences the sharing of practical knowledge in this investigation. Whilst it is acknowledged that a detailed treatment of how trust and practical knowledge has not been investigated in SMEs thus far, research from each of the main literature areas are used to provide a broad picture of how trust may influence knowledge sharing in general terms over a number of relationship phases as identified from the literature.

2.4.2.1 COLLABORATIVE RELATIONSHIP CLASSIFICATION

Table 7 outlines a number of references that have considered how interpersonal and interorganisational relationships develop in the following ways:

- Trust development in interpersonal and interorganisational working relationships in general terms (Items 1 to 3) and SMEs (Items 4 to 6);
- Development of inter-personal and interorganisational collaborative relationships in general terms (Items 7 to 9) and SMEs (Items 10 to 12).

	Relationship/Collaboration Comparison Criteria			
Item No/Author/Year	Level and Type	Description	Role of Trust	Phases
1 Lewicki and Bunker (1996)	Interpersonal Working Relationships	Trust Development in Three sequential Phases [Emp]	Calculus, Knowledge, Identification	Phase changes due to change in Trust types
2 Schilke and Cook (2013)	Interpersonal and Interorganisational Relationships	Cross-Level Trust Development in Interorganisational and Interpersonal levels [Con]	Individual to Organisational; Individual to Individual; Individual to Organisational; Organisational to Organisational	Initiation, Negotiation, Formation, Operation
3 Nielsen (2004)	Inter-Personal and Interorganisational Collaborative Relationships	Multi-dimensional Trust in Collaborative Relationships [Con]	Formation: Cognitive, Affective, Calculus; Implementation: Deterrence; Evolution: Calculus, Deterrence	Formation. Implementation, Evolution
4 Dowell, Morrison, Heffernan (2015)	Interpersonal and Interorganisational B2B Relationships	Trust Development in SME B2B Relationships [Emp]	Affective Trust dominant in Early Phase, Cognitive Trust in Mature Phase, Mediating role of Commitment and Liking	Early Phase, Mature Phase
5 Wang Peverelli and Bossink (2015)	Interpersonal and Interorganisational Cooperative Relationships	Asymmetric Trust in SME and Large Company Cooperative Relationships [Emp]	Perceived Trust Asymmetry, Changes in Cognitive and Affect Trust Asymmetry at each phase	Exploration, Building Commitment, Long-Term Commitment
6 Dowell, Heffernan and Morrison (2013)	Interpersonal and Interorganisational B2B Relationships	Trust in Small and Large B2B Relationships [Emp]	Ability (Expertise, Comms); Integrity (Honesty, Integral Actions, Candid Responses); Benevolence (Trust Actions and Attitudes).	Growth Phase
7 Larson 1992	Interorganisational Network Dyads	Development of Small and Large Dyadic Collaborative Relationships [Emp]	Reputation, Uncertainty Reduction; Mutual Economic Advantage, Reciprocity, Operational Integration, Social Control	Preconditions for Exchange, Conditions to Build, Integration & Control
8 Carbone (1999), Ford et al. (2011)	Interorganisational Collaborative Relationships	Involvement and Regularity in Supplier Relationships [Emp]	Moderate to High Trust characterised in High Regularity and High Involvement scenarios	High/Low Regularity, High/Low Involvement
9 Pisano and Verganti (2008)	Interorganisational Collaborative Relationships	Collaboration architecture outlining four modes of Collaboration [Emp]	Implications for Trust implied through the mode of Participation and Governance chosen	Closed/Open Participation, Hierarchical/Flat Governance
10 Franco and Hasse (2015)	Interorganisational Alliances	Four types of SME Interorganisational Alliances [Emp]	Each type of Alliance behaviours hold different implications for Trust	Deliberate, Exploratory, Improvised, Strategic
11 Tobiassen and Petersen (2018)	Interorganisational Collaborative Relationships	Trust based Relationships between High Tech SMEs and Large customers [Emp]	Approaches used to attract Large customers and mechanisms used to build trusting relationships by High Tech SMEs	Early Phase; Long Term Phase
12 Partanen et al. (2008)	Interorganisational Collaborative Relationships	Role of Social Capital in the Relationships formed by Science and Technology based SMEs [Emp]	The roles of various forms of Social Capital (Structural, Relational & Cognitive) are observed and the manner in which they leverage resources to transfer project activities from one phase to the next.	Innovation Assessment, Offering Development, Commercialisation, Achieving Rapid Growth

Key:
Emp: Empirical; Con: Conceptual

Table 7: Trust Development and Collaborative Relationship Approaches

The vast majority of approaches as shown in Table 7 appear to have investigated the development of trust and collaborative relationships at both the interpersonal and interorganisational levels. Most typical of this is the conceptual framework proposed by Nielsen (2004) who considered trust development in the formation, implementation and evolution phases. However, no single approach encompasses the four phases together.

Three models proposed by Dowell, Morrison and Heffernan (2015), Wang, Peverelli and Bossink (2015) and Tobiassen and Petersen (2018), have also considered some form of conclusion phase, where long-term issues are deliberated.

Considering models that study collaborative relationships, researchers appear to have focused their efforts on the development of relationships at the interorganisational level.

Two approaches have considered specific configurations or types of collaborative relationship. For example, Carbone (1999) has formulated a supplier relationship model of high/low regularity and high/low involvement. Pisano and Verganti (2008) proposed closed/open participation and hierarchical/flat governance. Lastly, Franco and Hasse (2015) proposed four types of inter-firm alliances, which are deliberate, exploratory, improvised and strategic. It is noted that each approach represents a specific type of collaboration that could evolve from one type to another during the course of a research project or initiative.

The remaining three models or taxonomies appear to study collaborative relationships in a number of developmental phases in a similar manner to the first group on trust development. It should however be noted that specific implications for trust are implied in broad terms in most of the models or taxonomies outlined for the collaborative relationships as outlined in Table 7 For example Larson (1992) considered the development of dyadic collaborative relationships in three phases; preconditions for exchange, conditions to build and integration and control. It is noted that the phases as outlined by Larson (1992) in some respects are similar to those formulated by Nielsen (2004) as outlined earlier.

For the first or relationship implementation phase Larson (1992) focuses on how both personal and company reputation reduce uncertainty, establish expectations and facilitate collaboration between partnering companies. Nielsen (2004) on the other hand, outlines how working relationships develop based on prior and no prior experience between two companies and trust implications in both scenarios. In addition to this, Nielsen (2004) also outlines how initial trust building activities are developed based on for example, open and honest communication and alignment of expectations (Etgar 1979).

In the second or relationship implementation phase, the main aim for Larson (1992) has been to establish the conditions necessary to build relationships. More specifically, this phase is characterised by mutual exchanges of dialogue where control may be exercised and results in the development of trust and reciprocity. The aim of such exchange was to agree a set of expectations, rules and procedures on how partners should work together during the course of a project (Larson 1992). Nielsen (2004) similarly outlined that this phase is concerned with governance and control, where rules for transaction and mechanisms to support decision making are negotiated between collaborating companies.

For the final or operational phase Larson (1992) outlined how collaborating partners become operationally and strategic integrated, which is characterised by numerous communication linkages that facilitate dense communication across firm boundaries. The author also noted the importance of what is called *'social control'* which is a more 'soft' form of control where self-regulation is exercised by individuals with moral considerations and joint control by a number of company personnel.

Nielsen (2004), has adopted a similar position to Larson and noted that within this relationship phase, collaborating companies concern themselves with various forms of performance evaluation, which are achieved through monitoring subjective and objective measures. Both authors acknowledge the importance of trust facilitating performance evaluation as it reduces conflict and accommodates

for imperfections, or vague areas in an agreement that may exist between the collaborating companies.

While performance evaluation may be important, varying forms of informal learning may also form a key part of the operational activities of small to medium enterprises. As noted earlier when investigating various forms of practice based theories, informal or experiential type learning provides a good base for studying how trust influences knowledge sharing.

When investigating SMEs, Zhang, MacPherson and Jones (2006) observed that owners of innovative SMEs were outward facing and encouraged wide and deep learning. This was in contrast to less innovative or stable SMEs, who were more inward facing, where learning was generally found to be experiential between a small number of personnel or groups. Saunders, Gray and Goregaokar (2014) also observed that more innovative SMEs are more committed to learning than their less innovative counterparts and observed that most of the learning is informal and undertaken by networking, mentoring and coaching.

The models proposed by Dowell, Morrison and Heffernan (2015), Wang, Pverelli and Bossink (2015) and Tobiassen and Petersen (2018), appear to consider an end or conclusion phase. For example, at the mature phase of working relationships, Dowell, Morrison and Heffernan (2015) have observed that partners are assessed on work related outcomes, rather than social interactions. When investigating asymmetric collaborations, Wang, Peverelli and Bossink (2015) observed that at the long-term commitment stage of collaborations, the trust gap narrowed, having reached a consensus on how to co-operate on future projects. For engineering based companies, project partners from different collaborating companies may meet together with a view to identifying lessons learned which may be taken forward onto other future initiatives. As with informal learning, this type of collective reflection activity may also provide a good medium to study how trust influences knowledge sharing within an organisational context. Such activities are given different names by companies; where they may be called project evaluations, post project reviews, or project post mortems (Birk, Dingsoyr and Stalhane 2002).

Similar activities to project post mortems and post project reviews are design reviews, which are typically conducted by SMEs with their customers, who may be a larger company. Given the multi-faceted nature of markets, Sjoerdsma and van Weele (2015) have noted that organisations can no longer rely on their resources to innovate and are therefore looking outside of their own boundaries and working with suppliers. When developing new products, the authors identified that a positive relationship existed between the quality of the relationship, knowledge sharing and new product development (NPD) outcomes. It was also noted that a good quality of relationship allows for more innovative ideas and solutions to be shared between partners, this in turn produced more positive NPD outcomes. In their research however, Sjoerdsma and van Weele (2015) also observed that a lower quality of relationship also had a negative impact on NPD outcomes. Interestingly, the authors identify twelve constructs that are important to the quality of buyer-seller relationships at the organisational and individual levels. Trust, communication, information and knowledge sharing are identified as important constructs at the individual level and important to the quality of collaborative relationships.

Table 8 outlines the relationship phases and constituent activities to be considered for investigation in this research project.

1	RELATIONSHIP FORMATION
	Partner Identification and Selection with Initial Trust Building
2	RELATIONSHIP IMPLMENTATION
	Contract Negotiation and Development
3	RELATIONSHIP EVOLUTION
	Informal Learning)
4	RELATIONSHIP CONCLUSION
	Collective Reflection

Table 8: Relationship Phases and Activities Considered for Investigation

2.4.2.2 RELATIONSHIP FORMATION

Typically at the relation formation phase, companies would be looking to identify, select partners and commence initial trust building activities. Company identification and selection may be made on the basis of the specific knowledge or expertise however, if the partner is already known, or not known, then initial trust building may proceed in different ways.

Collaborating partners may be identified through reputation. Hong and Yang (2009) for example identified that organisational reputation and relationship satisfaction predicted positive customer word-of-mouth recommendations. As a consequence, Hong and Yang (2009) comment that in order for customers to promote positive word-of-mouth recommendations, companies need to develop a favourable reputation. Such a favourable reputation may be promoted within a company, and become an accepted view, or generalised morality (Granovetter 1985), or through existing partners with whom a company may work.

Such a generalised morality, may inform the development of institutional based trust (Zucker 1986). It is noted further that within Nielsen's (2004) taxonomy, institutional based trust may inform and hence drive a range of decisions as this features in all relationship phases.

When studying the search processes to identify partners of a sample 118 technology companies, Nijssen, Van Reekum, and Hulshoff (2001) found that most used informal means, such as their own contacts for information. In the same study, the authors observed that top management's involvement and level of pro-activeness had a positive impact on the selection of a partner. The level of formalisation of the search procedure however, did not positively impact on the partner search outcome (Nijssen, Van Reekum, and Hulshoff 2001). While the authors noted different outcomes from other research initiatives it is thought that the level of formalisation would be dependent on the industry sector within which a company operates in. For example, Pidduck (2006) found that companies operating within the software industry sector identified alliance partners through a complex negotiation process, which featured cyclical negotiation, numerous types

of partners, levels of alliance formation, with latent items such as personal relationships and perceived reputations.

Considering partners, based on previous experiences may prove easier as trust developed through previous endeavours may add weight to justifying the selection of such a company (Das and Teng 1998).

Considering the types of activities as those outlined, it is considered that partners would be identified and selected on the basis of cognitive trust when considering the ability, or competence of partners (McAllister 1995). This would then be supported by affective trust when developing inter-personal relationships based on benevolence (McAllister 1995). Cognitive and affective trust are evident in phase one of the taxonomies proposed by Nielsen (2004) and Shilke and Cook (2013).

After choosing a partner with whom a company has no prior relationship, Lewicki and Bunker (1996) observed that relationships development on a calculative basis. The trust assured on a calculative basis by potential rewards of being trusted and a threat if trust is violated in some way. This may result in a reduction in the reputation in one or a number of partners associated with the relationship (i.e. based on the knowledge of compliance and non-compliance). It is noted that this form of trust as developed by Lewicki and Bunker (1996) is an extension of deterrence trust (i.e. trust based on non-compliance), which was originally developed by Shapiro, Sheppard and Cheraskin (1992).

It is also noted that both Lewicki and Bunker (1996) and Nielsen (2004) also included calculus trust in phase one of their relationship taxonomies.

At the early trust building phase, initial communication may be conducted in an open and honest manner which may help to foster trust, resolve differences and align expectations (Etgar 1979). These activities lay the foundation for developing good quality relationships through relational embeddedness (Granovetter 1985).

Partners may then look to agree on the aims of collaborating. It is noted that whilst companies may broadly agree on the purpose of such an exercise, they may have different reasons for doing it (Vangen and Huxham 2003). At the start of a relationship, other barriers may dictate the way partners behave and hence to some extent limit them from engaging in a meaningful way.

Barriers to initial trust building activities identified by researchers include the following items:

- Communication issues between partners;
- Cultural differences between partners;
- Ambiguous nature of key members of the collaboration;
- Complexity of hierarchies utilised by partners.

When investigating the key challenges facing the early stages of collaborations, Kelly, Schaan and Joncas (2002) found that the majority of issues identified at the start-up stage by technology companies were related to communication and cultural issues between collaborating partners. In the investigation, the participants reported that in the first year, their alliance was affected by misunderstandings caused for example by logistics, personality conflicts and language differences between international partners.

Bond III and Houston (2003) also observed that technical specialists who work within a functional department develop a shared language that is understood by insiders and could be misinterpreted by outsiders. As a result, the shared language used by such specialists operating within collaborative relationships, may also be a cause of misinterpretation at the first and subsequent relationship phases.

Kelly, Schaan and Joncas (2002) also identified relationship problems grounded in cultural mismatches and misunderstandings. It is noted further that such cultural mismatches and misunderstandings for some alliances may have contributed to the communication issues as outlined previously.

Both Vangen and Huxham (2003) and Kelly, Schaan and Joncas (2002) identified structural issues as being a barrier to initial trust building. More specifically, Vangen and Huxham (2003) noted that for some alliances there was ambiguity as to whom the key partners were, and this lack of clarity was particularly exacerbated where collaborations were characterised by complex hierarchies. Similarly, Kelly, Schaan and Joncas (2002) found that for some alliances, there was confusion as to the specific roles and responsibilities of some partners.

2.4.2.2.1 SME PERSPECTIVE

A number of researchers have noted that a source of SMEs' competitiveness has been realised through the way they utilise external networks. For example, Noteboom (1994) had observed the efficient manner in which SMEs utilised external networks contributing to their success and enabling them to overcome economies of scale by leveraging resources within networks (Van Dijik et al. 1997).

SMEs and large companies alike have used networks to identify partners and collaborate (Narula 2004, Lee et al 2010, Meriläinen, Vuori and Helander 2017). Invariably, SMEs have benefitted from identifying partners and larger companies have also gained by exploiting the flexibility of their smaller counterparts. It has however been noted that while large companies have increased their level of flexibility, this had reduced SMEs' ability to compete against larger companies (Narula 2004).

When investigating SMEs' working practices in open innovation, Lee et al. (2010) acknowledged smaller companies limited abilities to identify partners. In doing so, the authors proposed that an SME should develop a relationship with another intermediary company such as another SME to help them identify suitable partners, and also to build and manage collaborative networks. Lee et al. (2010) called this scenario an *'intermediary collaboration'*.

It is noted that Lee et al (2010) propose that an intermediary organisation would utilise one or a number of databases to identify market opportunities, competitors and potential partners, who may be either be an SME or larger company.

When studying the search processes used by companies to identify technology partners Nijssen, Van Reekum, and Hulshoff (2001) observed that small companies had fewer problems identifying partners to work with than the larger companies within their sample. In light of this finding, the authors suggest that larger firms may want to learn from small in complementary areas of business.

It is acknowledged that partner selection is one of the most important factors that determine the success of collaborations, particularly for SMEs (Kirby and Kaiser 2003).

When considering specific partner selection criteria, Geringer (1991) and Ariño et al. (1997) suggested two categories that should be used as follows:

- Criteria related specifically to the types of business activities and abilities required to undertake them.
- Criteria related to the type of personality of a potential partner.

Considering the first item from an SME perspective, when investigating partner selection Hoffman and Schlosser (2001) noted that SME sought partners with specific expertise and complementary resources. When considering the second item, Swoboda et al. (2011) for example, SMEs within the manufacturing sector in Germany emphasised cultural fit between collaborating partners as being the important factor.

Start-up SMEs may be seen as having a 'liability of newness' (Stinchcombe 1965) and as consequence see the need to gain recognition or legitimacy, particularly when their products are highly innovative (Stuart, Hoang and Hybels 1999). Elfring and Hulsink (2003) noted that SMEs may use networks to develop their reputation by building strong links with well-known companies who have access to customers and other partners.

Company selection, as noted above is generally seen as being a good thing and could potentially boost a company's reputation. When investigating contracting processes from an SME perspective; Blomqvist, Hurmelinna and Seppanen,

(2005) however noted that adverse selection, or selection resulting in a company not being chosen for some reason, might damage the reputation of a company.

While investigating the early stage activities of three SMEs, two of which worked in the oil and gas sector and one in the fishery sector Tobiassen and Petersen (2018) observed that all companies used a process of attraction and trust building. Both companies approached potential research and industry based customers to discuss their ideas and gauge their interest. It is noted that this process helped the companies to understand the customer's needs and at the same time build trust. The owners of both SMEs also envisaged that if the customers bought into the innovation process, then this may increase the chance of them making a sale (Tobiassen and Petersen 2018). This process of simultaneous product and market creation resulted in both customers being interested in the SMEs' ideas and wanted to collaborate.

The third SME, who worked within the fishery sector supplied equipment to a research institute over a number of years. Realising that the research company was developing cutting edge technologies, the SME owner saw that it was in their interest to work closer with the research company thereby strengthening the SME's position within the market (Tobiassen and Petersen 2018). As a consequence, the SME owner decided to provide a good service to its customer in order for it to get recognised. The authors noted that the research company came to recognise the SME as being a valued supplier and became interested in collaborating with them (Tobiassen and Petersen 2018).

Both scenarios as observed by Tobiassen and Petersen are quite typical of approaches utilised by SMEs to develop their businesses and may be used in conjunction with the networking approaches as investigated by Elfring and Hulsink (2003).

Laursen and Andersen (2016) identified that the timing of involvement between partners presents companies with a challenge as new product development projects are characterised by a high degree of uncertainty, which may lead to causal ambiguity in project operations.

From a new product development perspective, causal ambiguity is a concept that informally relates to the problem of articulating the precise nature of connectedness between knowledge, technology and outcomes (Bstieler and Hemmert 2010). After investigating varying degrees of causal ambiguity between a large company and supplier, Laursen and Andersen (2016) identified that this factor influenced the way the two partners interacted and utilised resources before, during and after an interaction.

More specifically, when task clarity was low and causal ambiguity is high, the supplier company was observed to seek clarity from the large company and advance the project. In the case of high task clarity and low causal ambiguity the opposite was noted where the supplier was observed to advance a project through sharing knowledge with the other partner (Laursen and Andersen 2016). Interestingly, between the two scenarios at moderate task clarity and causal ambiguity, typically when considering the next project task, suppliers were observed as discerning what the next task could be and the value they could gain from executing it (Laursen and Andersen 2016).

Given the aforementioned scenarios and where both companies did not correspond very often, Laursen and Andersen (2016) observed that the large company evaluated the supplier company's performance based on the supplier's ability to move a project on (e.g. through sharing new knowledge, or showing evidence of executing project tasks).

The work of Laursen and Andersen (2016) clearly demonstrates that causal ambiguity holds implications for trust and knowledge sharing. Szulanski, Cappetta and Jensen (2004) observed that as the level of casual ambiguity of knowledge increases, the trustworthiness of the source reduces. As such, causal ambiguity has a moderating effect on the sharing of knowledge. The authors note further this has the impact of grounding the trustor's reality from their perception, resulting in further confirmation being required (Szulanski, Cappetta and Jensen 2004).

Dowell, Morrison and Heffernan (2015) identify affective trust as playing a dominant role at the first phase in SMEs. This is observed as being vastly different to Nielsen (2004) and Shilke and Cook (2013), who observed that both cognitive and affective trust were utilised at this relationship phase.

It should however be noted that Dowell, Morrison and Heffernan (2015) identified the trust antecedent of integrity played a significant part on trust outcomes. The same authors also noted integrity as being a solely affective trust item; however Barnard, Schunk and De Beer (2008) have observed that integrity has both a cognitive and affective component.

In the absence of calculus and cognitive trust, institutional trust (Zucker 1986) may also inform decisions to exercise affective trust early in a relationship.

2.4.2.3 RELATIONSHIP IMPLEMENTATION

In the second relationship phase collaborating partners would negotiate the terms of the collaboration and subsequently develop an agreement or contract to assure effective project delivery.

In their research, Woolthius, Hillebrand and Nooteboom, (2005) observe that trust between partners within a collaboration generally leads to detail contracting. Collaborative relationships characterised by trust are generally regarded as a success, which appears to agree with other research which regards trust an important factor in contributing to the development of a productive environment. It has been noted further that contractual incentives and associated project monitoring may promote adverse behaviours by contractors and conversely higher trust would promote higher project performance (Kadefors 2004).

Woolthius, Hillebrand and Nooteboom, (2005) note further that contracts and trust may complement and substitute one another. If a contract is not a legal requirement, then trust and a contract may be complementary. If however no safeguarding clauses are used in a contract, then trust may well substitute for a contract. Conversely, when low levels of trust exist between partners and detailed contracts are used then a contract may be seen as a substitute for trust.

When partners are working together for the first time, all parties may work together from a position of calculus, or even deterrence trust (Shapiro, Sheppard and Cheraskin 1992, Lewicki and Polin 2013). Subsequently, as partners become to know each other and their abilities are demonstrated, key members may work together on a basis of knowledge based (cognitive) trust. This form of trust is where partners trust each other to keep their word and develop the ability to accurately predict how each other will behave (Lewicki and Polin 2013).

The forms of trust outlined above are observed in the models and taxonomies outlined by Lewicki and Bunker (1996) and Nielsen (2004). The latter model by Nielsen (2004) does however outline that institutional trust will also have a role to play in all relationship phases.

Lewicki and Polin (2013) note that in some instances, trust developed between partners at this stage may even develop further to identification based trust. This form of trust is the highest order of trust (Shapiro, Sheppard and Cheraskin 1992) where partners know each other really well and understand each other's behaviours and actions to a high degree. Very few collaborative relationships however evolve to this level where this form of trust is developed (Lewicki and Bunker 1996).

It is also noted by Lewicki and Polin (2013) that identification based trust is sometimes evidenced in integrative (win-win) negotiations (Walton and McKersie 1965).

The primary role of negotiation is for one partner to make the other partner(s) see their view and in order for points to be believed, trust needs to be exercised as partners may invariably have no way of confirming all, or some of the statements made (Lewicki and Polin 2013). As a consequence, trust is an integral part of the negotiation process.

Whilst negotiating, collaborating partners may look for cues of trustworthiness in terms of for example ability, integrity and benevolence from the other partner(s) in

order to negotiate the project aims, objectives and other associated items. Lewicki and Polin (2013) for example outline one partner may look to establish his or her credibility by providing information to the other negotiators that is accurate and verifiable. A partner may also want to exercise benevolence with others by regularly showing courtesy and respect. By demonstrating such trust behaviours this can help partners to develop their reputation, which may be used in other future collaborations.

The importance of communication media at the relationship implementation stage has also been identified as being particularly important by trust researchers. For example, Daft and Lengel (1986) and Swaab et al. (2012) note that communication media has an important role in reducing the ambiguity reduction to convey multiple cues and subtleties in such a manner that will enable personnel to work together effectively. Lewicki and Polin (2013) build on the aforementioned view and recognise that communication media is an important mechanism in conveying truth telling and hence providing evidence of trust behaviours of collaborative partners. Lewicki and Polin (2013) also indicate the importance of recognising patterns of verbal and non-verbal cues that act as indicators of trustworthiness and hence provide a foundation for developing trust. Face to face communication may provide a better way of establishing trust than by using e-mail. In doing so, trustworthiness can be signalled not only verbally but emotionally (Boone and Buck 2003).

Given that communication in this phase, particularly in negotiation activities need to foster trust building whilst making decisions as a collective, then it is thought that face to face communication may be the most suitable form of knowledge sharing mechanism.

The relationship between trust and control appears to be an area of attention where a number of research initiatives view contracts as having a dual role of control or coordination and trust as a moderating function. Mellewigt, Madhok and Weibel, (2007) for example, identify trust as being a moderating variable that influences the relationship between control, coordination activities and the extent of contracting. As a result, trust can substitute for contracting with respect to

control activities. In addition, trust can also complement contracting with respect to coordination activities between partners.

Based on conceptual research, Das and Teng (1998) make the argument that trust and control are parallel concepts and their relationship is supplementary in nature whilst generating confidence between partners. The authors outline that control mechanisms (e.g. project control settings) may impact positively or negatively on the level of trust. For example, Sitken and Stickel (1996) found that formal control systems can lead to low trust behaviours if they are not deemed to be fit for purpose.

In addition, Das and Teng (1998) proposed that the trust level through trust building moderates the effect of control mechanisms in determining the control level. The authors' rational for this proposition is that a minimum level of inter-firm trust is required to get partners to agree project goals, rules, and work together. As interorganisational trust develops, partners develop faith in their project control systems and as partners work together, they further develop an understanding of each other working practices.

Both Das and Teng (1998) and Mellewigt, Madhok and Weibel, (2007) share the same view of trust as a moderating variable on control, however Das and Teng's research appears to provide further insight into how trust directly moderates the deployment of control mechanisms, which in turn moderates the control level itself.

Given the above proposition of trust and control by Das and Teng (1998), it can be deducted that the choice of control mechanism may also inform what trust antecedents (Mayer, Davis and Schoorman 1995) are selected and the level of trust enacted. Notwithstanding the impact of an individual's propensity to trust as noted by Colquitt, Scott and LePine (2007). It would therefore follow then that the choice of trust antecedents may also play a role in moderating the effect of the control mechanism and the control level.

2.4.2.3.1 SME PERSPECTIVE:

The initial negotiation activities of SMEs may be somewhat different to their larger counterparts given their difficulty to identify partners as noted by Lee et al. (2010) and asymmetries of power and trust, which may exist from the outset when negotiating with larger companies (Wang, Peverelli and Bossink 2015).

SMEs may however have some advantages given the flat structures and shorter decision making chains that exist as noted by Ghobadian and Gallear (1997) and Nicolescu (2009) which may result in negotiations being executed within a shorter time-frame. This may be particularly evident when an owner-manager of an SME takes part in negotiations and potentially has the power to make big decisions 'on the spot'. As a result, it is then envisaged that SMEs may work with their partners from a position of calculus trust, which through time may evolve to cognitive trust (Lewis and Weigert 1985, Lewicki and Bunker 1996). This is consistent with the finding of Dowell, Morrison and Heffernan (2015) who observed cognitive trust being exercised in the later stages of their trust based relationship model.

Nielsen (2004) observed that institutional trust plays a role of informing decisions in all relationship phases. Given the unified culture that may be evident in SMEs (Ghobadian and Gallear 1996), then it is anticipated that institutional trust may also inform decision making in a similar manner in SMEs. For example, when studying how high tech SMEs are financed in China, Xiao and North (2012) found that both institutional trust and personal connections played a critical role in securing equity investment capital.

As outlined previously from a general perspective, it has been established that a successful negotiation is typically composed of an exchange of dialogue that promotes trust based behaviours, which is best achieved through face-to-face communication. Case study research that has investigated knowledge sharing in SMEs within the UK by Staplehurst and Ragsdell (2010) identified meeting rooms, desks and outside of office (during work time) as the most popular means of sharing knowledge. This finding quite clearly appears to indicate that face-to-face communication would also be most suitable mechanism for sharing

knowledge. It is however, acknowledged that the research conducted by Staplehurst and Ragsdell (2010) has a general focus and therefore it could apply to any relationship phase.

Asymmetry in its various forms, such as asymmetrical information, collaboration and trust, have been the focus of more recent research in SMEs, where researchers seem to agree that the challenges faced appear to be embraced by SMEs. For example, Usai et al. (2018) investigated how entrepreneurs overcome imperfections (in terms of risk management, asymmetric information and hold-up problems) when innovating. The authors observed that by adopting an open innovation model, entrepreneurs used their skills, aptitude and attitude to develop new products. In essence, they embraced their circumstances and turn it to their best advantage. Similarly, Jones et al. (2014) investigated whether SMEs can overcome challenges such as imbalances in power and resource deficiencies to leverage supply-chain relationships to gain competitive advantage. After collating data through semi-structured interviews and a survey of around two hundred SMEs in the manufacturing sector of the USA, Jones et al. (2014) found that SMEs were realising performance benefits through formulating trust based collaborations and demonstrating trustworthiness from a strategic perspective.

Based on case study research, Blomqvist, Hurmelinna, and Seppänen (2005) make recommendations on how trust and contracting can be balanced in asymmetric collaboration. Some of the recommendations are considered which are contrasted with other related research.

- A carefully designed and flexible contract that embraces the requirements of all partners in asymmetric collaboration (Blomqvist, Hurmelinna, and Seppänen 2005).

  The primary aims of designing a flexible contract may be for example; to strengthen continuity and protect each party's know-how. A contract brings people together to establish common goals and procedures thereby promoting continuity between partners. As a result, contracting establishes

and promotes collaborative relationships (Frankel, Schmitz-Whipple and Frayer 1996).

Blomqvist, Hurmelinna, and Seppänen (2005) acknowledge that the relevant legislation recognises that the creator of intellectual property rights (IPRs) belong to the partner who created them. As a result, Blomqvist, Hurmelinna, and Seppänen (2005) note that if it is required to allocate such rights, then the safest and most appropriate way of doing it would be through a contract. Given their lack of resources, it is envisaged that effective management of IP by SMEs may be problematic as noted by Kitching and Blackburn (1998), Eppinger and Vladova (2013) and Agostini, Filippini and Nosella (2014).

Early research on IPR management in SMEs in the four sectors of computer services, design, electronics and mechanical engineering by Kitching and Blackburn (1998) found that though owner-managers were aware of the practices to manage intellectual property they felt it was not worth investing in them. SME owner-managers viewed the costs of utilising informal practices as negligible as most of their intellectual property was integrated in their daily working practices. Kitching and Blackburn (1998) observed that even when SME utilised formal practices to protect their rights, they were unwilling to action where they suspected violations had taken place. More recent research by Eppinger and Vladova (2013) observed a similar scenario, where only one of the three SMEs investigated had personnel employed specifically to manage its IP. Challenges faced by SMEs identified within this study include not knowing the value of IP, which in turn impeded companies from licensing and selling, and which was further exacerbated by underestimation and not taking the time to screen existing, similar patents (Eppinger and Vladova 2013).

When investigating the influence of patents and trademarks on the economic and financial performance of SMEs in Italy, Agostini, Fillipini and Nosella (2014) found that being in possession of patents or trademarks did not influence sales growth and return on assets (ROA). Whilst indicating that SMEs within the researchers sample were registering various forms of

intellectual property, by and large the benefit of doing this was not evident. Agostini, Fillipini and Nosella (2014) noted that their results were in opposition to similar studies that have been conducted in the past. For example Ernst (1995) found that patent applications in medium and large German companies subsequently led to increases in sales after around two to three years. Noting that most of companies in their sample were small Agostini, Fillipini and Nosella (2014) observed that their results may be due to size of the companies that participated in the study. Thus all three studies appear to agree that patent systems seem to be utilised by medium to large companies who can justify and hence allocate relative amount of resources to make it work. This is in line with MacDonald (2004) who outlined that running a patent system may be appropriate for large companies but not for smaller firms who typically have more scarce resources.

- Contracting is more challenging between companies with different backgrounds (e.g. characteristics and culture) (Blomqvist, Hurmelinna, and Seppänen 2005).

  Conceptual research conducted by Zaheer and Zaheer (2006) who investigate the role of trust in collaborations between companies based in different countries outline some of the challenges that may be encountered. More specifically, the authors investigated the nature of trust in international collaborations from cultural and institutional perspectives. In order to do this, Zaheer and Zaheer (2006) proposed a model that links symmetry and asymmetry of institutional trust with low/high interdependence between partners. Even though the model is conceptual, it is worthwhile considering one example scenario within this model as it demonstrates how the concept of trust asymmetry can affect the way collaborative partnerships work. For example; when both companies have low institutional bases of trust, both companies are likely to invest in trust development and project controls. In the case of low interdependence, the level of investment may be high to the point that may hinder project performance. When the level of interdependence between partners is high, the level of investment in project controls may be low or optimal at most (Zaheer and Zaheer 2006). It is noted

that the first scenario (low institutional trust and low interdependence) seems to be similar to that of the Bosnian SME in the study conducted by Rus and Iglic (2005).

- Some cooperative threshold amount of trust is required for the contract to be signed and work to start (Blomqvist, Hurmelinna, and Seppänen 2005).

  Trust is generally acknowledge as a necessary precondition for exchange and therefore this must exist between partners who intend to negotiate some form of contract (Neu 1991).

  Trust researchers have also identified some scenarios where thresholds of trust may need to be overcome for trust based relationships to develop. Dibben, Morris and Lean (2000) for example proposed that some threshold between trust and level of co-operation between two partners needs to be met before a relationship can develop further. The authors note that when trust is greater than a cooperation threshold for one partner, then the relationship may go through a fragile period and the trusting partner may feel offended.

  Myhr and Spekman (2005) investigated trust and electronic mediated communication and through their research found that both items contributed to the development of collaborative relationships. The authors noted that after a base line level of trust was established through face to face communication, the level of trust was then reinforced and further developed by continuous follow-up electronic mediated communication, typically through e-mail exchange. In their study of supply-chain relationships, Myhr and Spekman (2005) also observed that when the base line level of trust had not been achieved, then collaboration typically by electronic means did not develop to a high level.

- Successful asymmetric R&D collaboration requires both contracts and trust (Blomqvist, Hurmelinna, and Seppänen 2005).

Woolthius, Hillebrand and Nooteboom, (2005) noted that contracts and trust may complement and substitute one another. Wang, Peverelli and Bossink (2015) on the other hand investigated how the asymmetric nature of trust changes when large companies with greater power collaborate with SMEs in China. Based on semi-structured interviews, non-participant observation and reviews of company documents, the authors collated qualitative data on asymmetric trust behaviours over three relationship stages (exploratory, building commitment and long-term commitment). Whilst a detailed treatment will not be provided, observations will be made on a summary of asymmetric trust behaviours for the first two phases.

The first phase exploratory activities entailed managers of a SME and larger company discussing the possibility of collaborating in non-work settings, which resulted in the large company expressing an interest in collaborating with the SME. In the second phase, both parties came to a position where they both believed that they could collaborate, which ultimately resulted in contracts being signed. In terms of trust behaviours, the initial position of both companies was that they were both aware of trust asymmetry. The SME then engaged in dialogue more actively than the larger company, demonstrating both cognitive and affective trust asymmetry by sharing personal experiences that evidence their abilities. Trust is enacted by the larger company who subsequently offers some low value contracts to the SME. Trust asymmetry is still evident as the large company exhibits passive behaviour towards the SME as they wait and see how the supplier will perform in due course (Wang, Peverelli and Bossink (2015).

In essence, the initial position of trust asymmetry of both companies is observed, which is then followed by enacted trust building by the SME, followed by the enacted trust response by the larger company. The aforementioned summary of trust asymmetry demonstrates quite clearly that asymmetric collaboration requires both trust and contracts. The main issue

with asymmetrical trust behaviours is that they can be misinterpreted by one or both partners resulting in potentially unpredictable outcomes.

Typically, mutual trust or trust based on rational choice (Kramer 1999) may develop incrementally through measured interactions that are predictable, and mutually reinforcing (Meyerson, Weick and Kramer 1996). However, Weber, Malhotra and Murnigham (2004) observed that irrational or asymmetric trust may typically be motivated by the following two items.

- Partners in trust based relationships may view their interaction differently.
- Each partner's behaviours may be biased and be motivated by issues related to reliance.

For instance, given the trust building behaviour of partner X, the other partner Y may perceive their behaviours from what was originally predicted which may result in the other partner Y building trust in a different manner to that which was originally intended by both parties (Weber, Malhotra and Murnigham 2004). It can therefore be seen that from the point when the perceptions of one partner are not met; subsequent trust building activities may have a negative impact on the trust developed between the two partners.

It can therefore be envisaged that Das and Teng's (1998) consideration of trust and control will only apply in the case of rational trust (Kramer 1999) when the behaviours of partners are predictable and trust is generally developed in a mutually reinforcing manner. Given the predictable nature of trust it would be assumed that there would be a certain level of alignment between the trust antecedents (Mayer, Davis and Schoorman 1995) utilised by key collaborating partners.

Conversely, Das and Teng's (1998) consideration would almost certainly not apply in the case of trust asymmetry or irrational trust (Weber, Malhotra and Murningham 2004) where the behaviours of partners are unpredictable and trust may develop in a negative manner. Given the unpredictable nature of trust in this

scenario, it is assumed that there would little, or no alignment of trust antecedents utilised by key collaborating partners.

The main findings from the research conducted by Blomqvist, Hurmelinna, and Seppänen (2005) indicates contracts alone cannot guarantee successful collaborations, however a contracting process may be used purposefully to promote mutual learning and understanding to build mutual trust. An imbalance of trust (or trust asymmetry) between partners may be characteristic of any form of collaboration, however trust asymmetry may well be in particular a defining element of an asymmetric collaboration. It should be noted that this form of trust may also be evident at any point during a relationship but particularly evident at the relationship implementation phase.

2.4.2.4 RELATIONSHIP EVOLUTION

Activities within this phase of the collaborative relationship consider workplace learning and more specifically those learning activities that are more informal in nature and hence more integral to the day to day activities undertaken between collaborative partners. Forms of learning considered in this phase include, informal or experiential learning (Matthews 1999; Eraut 2004a).

Also investigated within this phase is mentoring, which is considered by Eraut (2004a) on a continuum of formality as somewhere between formal and informal learning. Mentoring has however been considered as being formal and informal by Inzer and Crawford (2005), who define informal mentoring as *"a natural coming together between mentor and protégé (mentee) to share experiences and facilitate private and professional growth".* This is done through a long-term relationship, where personal and professional respect exists between both personnel. Formal mentoring is delivered through a structured program over a shorter time frame (Inzer and Crawford 2005). In this research, both forms of mentoring will be considered, whilst it is recognised that both forms of mentoring usually consider and tackle issues faced by mentees on a daily basis.

Marsick and Watkins (1990) note that informal learning may include mentoring and other forms of learning such as self-directed learning, coaching, networking

and practice (trial and error) that can occur anywhere and at any time. For example, research conducted by Dymock (1999) investigated mentoring, which was used as part of a leadership program for potential supervisors. From the mentoring process, it was noted that mentees had improved their understanding of the company operations and learned about how to deal with practical management issues. In addition, the mentors also learned from the mentoring process while realising some personal benefits (Dymock 1999).

When characterising informal learning, researchers typically contrast it with other forms of learning such as formal and non-formal learning. Formal learning can be regarded as the opposite to informal learning in that it is usually institutionally sponsored; classroom based and is highly structured and may lead to a recognised qualification (Marsick and Watkins 1990, Misko 2008).

Non-formal learning, on the other hand is similar to informal learning in that it can be undertaken in the workplace and does not lead to a recognised qualification, but differs in that learning takes place within a structured program (Misko 2008).

Eraut (2004a) defines informal learning simply as *"learning that is near to the informal end rather than formal end of a continuum of learning*". Drawing on the nature of informal learning as outlined by Eraut (2004a) a more appropriate definition may be outlined as "learning that is implicit, unintended, opportunistic and unstructured".

Informal learning is therefore integral to what personnel do in their day-to-day activities and therefore takes on many forms. For example Eraut (2004b) outlines numerous ways informal learning can take within the work place such as task speed and fluency in task performance; facilitating social relations in teamwork and dealing with complexity in decision making.

Based on the work of Argyris and Schön (1974, 1978) and Kolb (1984), Marsick and Watkins (1990) distinguish another form of informal learning, that of incidental learning, which is defined as *"a by-product of some other activity such as task accomplishment, interpersonal interactions, sensing organisational*

culture and trial and error experimentation". As such, incidental learning is similar to informal learning, with the latter being viewed as being more planned and intentional in nature.

Researchers generally attest to informal learning as being tacit, highly contextual and therefore requires making knowledge explicit and codifying it (Wenger, 1998; Eraut 2004a). Informal learning has also been referred to by Marsick et al. (2008) as an amoeba like process, with iterative sub-phases where personnel move back and forth between different ventures of conversation and work whilst utilising different resources such as internet based systems and other technology in an attempt to identify new stimuli.

Marsick (2009) outlines a number of factors that are influential in providing more detail about the nature of informal learning as follows:

- Individuals' learning strategies are mediated by their beliefs, values, histories and socialisation. This may also influence the manner in which an individual goes about their learning such as their level of intentionality, proactivity and reflectivity.
- The context may greatly affect learning choices and triggers related to learning, associated resources utilised and influence of the environment.
- Relationships act as a facilitator and barrier and hence can be regarded as a mechanism for informal learning and aid the development of informal learning communities.
- Organisational factors such as leadership, organisational structure, culture, incentives and rewards influence a climate for learning and hence may be promoted in a certain way to stimulate informal learning.
- Knowledge Management systems may be used by personnel to record their notable informal learning experiences and made available company-wide to help facilitate other personnel's informal learning.

From the above list it can be seen that an organisation's culture and environment are central factors that influence the informal learning experience. Trust is another factor that is not explicitly outlined within Marsick's (2009) list, it can

however be considered as being a product of an organisation's culture and environment that are learned and facilitates learning.

When studying social workers, Gola (2009) characterises the informal learning processes utilised as being tacit, which can be enhanced by an individual's state of mind (consciousness and intentionality) and the manner in which the environment is supportive of learning. Similar research conducted by Hoekstra et al. (2009) who investigated the informal learning behaviours of teachers also noted the manner in which the working environment influenced their learning. Integral to the environment, the authors also noted that the participants' belief systems influenced the way they interpret and manage their environments.

Trust, just like organisational learning as conceptualised by Hedberg (1981) may become part of an organisation's routines, norms and values (Dogson 1993). As such, trust may become part of a learned product of a firm's experience or culture (Schein 1985). It is noted further that the shared 'scientific' culture as observed within the case studies analysed by Dogson (1993) contributed towards the success of collaborations in the long-term.

Recognising that the relationship between organisational learning and individual learning is far from straight forward, Dogson (1993) however outlines that there is some level of causality between the two, in that individuals are the primary learning entities in firms and it is such individuals who undertake activities that stimulate learning and thus promote organisational change.

As a relationship and a shared culture develop, informal learning provides the opportunity for reciprocity, which may facilitate the building of trust (Dogson 1993). Such a culture should be promoted in a manner so that an individual knows that they will not be punished for making mistakes when they learn (Marsick and Volpe 1999).

Preisendörfer (1995) supports the assumption that trust is not bound to any specific set of circumstances and is broadly based on individual, structural and cultural elements. This would therefore suggest trust and learning develop in a

similar manner as they are broadly influenced by the same factors. Similar to Dogson (1993), Campos-Castillo et al. (2016) also note that there may be causality between institutional trust and interpersonal trust however, like learning, the relationship is complex.

The concept of social learning as outlined by Gherardi (2006) demonstrates how all of the main factors as outlined by Marsick (2009) work together. While a detailed analysis will not be provided, an overview of social learning will be provided.

In social learning as proposed by Gherardi (2006), using an interpretative approach, practices are outlined at the individual, collective, organisational and societal levels. In the social learning model, Gherardi (2006) describes how learning takes place by examining the interwoven relationships between the levels and examines the journey of a novice as they negotiate the different levels through to the level of practitioner. It is noted that within the description, distinction is made to practice and tacit knowledge (skill and competence) and all activates that take place within the context of a community of practice and are typically mediated by social relations and material artefacts. Key items noted include the following:

- The use of senses in the art of practice and development of social identity.
- The use of language, when and when not to say things through 'knowledge pointers' and the development of aesthetic feelings (know-how), whilst being continuously exposed to practice.
- Learning through experience, where the understanding of cultural and other behavioural aspects of practice (e.g. power) are developed thereby leading to the development of the identity of a practitioner.

Reflection as an integral task of informal learning will be considered as it has an important role of increasing the utility of the learning experience by promoting continuous improvement (Heyler 2015). Reflection also provides the learner with the opportunity to consider trust related issues typically during reflection-on-action as noted by Schön (1983, 1987). It is thought that while trust issues may

be considered while reflecting in action, the opportunity to do this may be minimal given that learning may be more incidental at this stage. Obviously, the opportunity to do this would depend largely on the nature of the activity being undertaken. In addition to this, given the single and double loop learning processes that may be utilised as proposed by Argyris and Schön (1974) and Argyris (1999), may suggest that two forms of reflection-on-action may be used, one which is short-term and the other that is more reflexive (Luhmann 1995) in nature where the goals of working practices may be re-evaluated. Again, trust related issues may be considered in both instances whether they relate to for example the choice of materials used within a specific process or the configuration of production process utilised.

Criticisms of Schön's (1983, 1987) reflection in and on action does however provide additional opportunities to consider trust related issues further. For example, Greenwood (1993) outlined that by focussing on reflection in and on action this under values reflection before action. The author does however concede that it is arguable that most errors could be conceived before they have actually taken place. Reflection before action is without doubt another precaution that can be considered, however to become 'good' at it presupposes having some experience of the trustworthiness of similar sub-system elements. Incidental to this, Greenwood (1993) notes that for reflection in and on action requires agents to become proficient at reasoning between actions and intentions through system governed feedback, which is one area not considered by Schön.

In order to maximise the learning experience, Edwards (2017), like Greenwood (1993) proposes reflection-before-action to help novices to prepare for practical scenarios before entering into them.

Edwards (2017) also recognises that many reflective accounts written using reflective frameworks as part of reflection-on-action are without full meaning that do not give accounts of why, or how the novice improved as a consequence of an experience. As a consequence, Edwards (2017) proposes reflection-beyond-action where a story is formulated, which promotes self-exploration and evidences transformative learning. The learning process utilised here appears to

be similar to that of double loop learning as proposed by Argyris and Schön (1974) and Argyris (1999) where a deeper form of reflection takes place. Marsick and Watkins (1990) term this critical reflectivity which involves critiquing one's actions, underlying values and assumptions when the desired outcomes did not materialise.

In providing an example for a reflection-beyond-action story Edwards (2017) provides details of example tasks where theory and practice are compared and supplemented by descriptive details of working relationships that enabled or obstructed the tasks. Given the authentic nature of such stories provides information related to trust related data on numerous levels, most notably at the task level between human and materials and in working relationships between people.

One key mechanism recognised by researchers and practitioners alike for managing reflective activities to support work based informal learning is mentoring where the relationship between mentors and mentees also holds implications for trust and knowledge sharing.

A number of researchers have identified the different ways in which reflective activities are undertaken while novices are engaged in some form of mentor-mentee relationship. Tillman (2003) for example has researched how first year teachers used reciprocal journaling as part of the mentoring process to help them record the challenges they faced and help them reflect with their mentors. It noted here that while the learning may be informal in nature, the arrangements for mentoring are slightly more formal arrangement in that a mentor had been selected to oversee the development of the teacher. The arrangement as described by Tillman (2003) is similar to that proposed by Edwards (2017) who proposed that stories noted as part of reflection-beyond-action activities should be reviewed with mentors.

It has also been noted that mentors play a vital role during mentees' informal learning and these also influence the learning environment. This was observed when studying new teacher learning, where the natural mentor environment was

noted to be deeply affective in nature, and relationships between colleagues were deemed important (McNally, et al. 2004).

Trust has also been observed by Fleig-Palmer and Schoorman (2011) to moderate the relationship between the mentoring relationship and knowledge sharing.

Conceptual research by Inkpen and Currall (2004) investigated how learning between collaborating partners holds implications for trust behaviours and control in joint ventures. Specific propositions proposed by Inkpen and Currall (2004) are used here as a means to study how trust develops when collaborating partners learn about each other in a mutual or symmetrical manner and one partner learns from the other in an asymmetrical manner.

Whilst it is acknowledged that one partner will learn from the other partner(s) as a means to execute numerous project tasks, the second scenario refers to learning by one partner in a manner that would result in a material gain in bargaining power.

- Learning about a partner may reduce the need for formal project controls (Inkpen and Currall 2004).
  When learning is mutual between collaborating firms, Inkpen and Currall (2004) observed that this will act as a mechanism to develop trust and potentially inform what project controls are utilised.

  Partners may learn about the environments both internal and external to a partnership that each other operate in, which may inform what initial assumptions are made (Doz and Shuen 1995). Key personnel may then learn how to execute project tasks and decision making processes more effectively through shared capabilities. Through time, partners may also come to exploit their unique capabilities within a collaboration (Doz and Shuen 1995).

After initially setting their project goals, as it is delivered, given the changes to processes and tasks as outlined, personnel may review and revise their goals to ensure a practical level of congruence (Doz and Shuen 1995).

All the aforementioned learning activities themselves ultimately result in the partners becoming more confident in working with each other, which may result in a reduction in ambiguity in communication and enable all parties to work together more effectively (Axelrod 1984). Knowledge shared between partners by and large may be explicit knowledge and tacit knowledge (Polanyi 1962) primarily through learning the decision making processes utilised by each organisation. Typical items learned informally identified by Eraut (2004a) include task performance (e.g. task speed and fluency) and awareness and understanding (e.g. contexts and situations).

Given the range of activities outlined, where partners are not known to each other, calculus trust (Lewicki and Bunker 1996) may evolve into cognitive trust (Lewis and Weigert 1985) where partners and their learning would be based on predictions of how each partner would execute project tasks. Affective trust may also be utilised, which may facilitate the sharing of tacit knowledge (Holste and Fields 2010).

The trustworthiness decisions of partners would mainly be based on ability, integrity and benevolence (Mayer, Davis and Schoorman 1995) in choosing the most appropriate ways to execute project tasks effectively in the best interests of all partners.

- Learning by one partner (e.g. through knowledge acquisition) which results in a shift in bargaining power, may reduce trust and lead to formal project controls being utilised (Inkpen and Currall 2004).

  Learning and knowledge creation are the central objectives of a partnership through the knowledge embedded within the individual members (Badaracco 1991). Learning by one partner, or asymmetrical learning may occur, which has a number of determinants and consequences for a collaborative

partnership. When studying International Joint Ventures (IJVs), Hamel (1991) observed that transparency (openness) and receptivity were identified as determinants of asymmetries of learning and may result in a shift in bargaining power. In addition, when put in such a position, Hamel (19991) also noted that the non-learning company may regard this as a competitive move, as they become aware of skill convergence, and result in a reduction in cooperation and trust. In some situations this may even make the original agreement obsolete.

Generally, tacit and explicit knowledge (Polyani 1958) would be shared in for example, practical learning by doing activities (Eraut 2004a), where practice is recreated by co-constructing actions by performers and facilitated by reflective dialogue with observers (Lohman, 2006).

As one of the partners becomes aware of the asymmetry of learning, this may result in a reversal in the position of trust from cognitive and affective trust Lewis and Weigert (1985) to that of calculus trust (Lewicki and Bunker 1996). As a result, the trust antecedents may be based on low integrity, and benevolence (Mayer, Davis and Shoorman 1995).

Asymmetry of learning, may also result in asymmetry of trust (Wang, Peverelli and Bossink 2015) and hence a reduction of trust between the partners. This reduction in trust may be particularly evident when the learning partner is not contributing any skills themselves, which in term may result in formal controls being implemented by the other firm (Inkpen and Currall 2004).

- Learning by one partner, which leads to increased dependence by the learning partner may increase the desire for social controls (Inkpen and Currall 2004).

  In a situation where the trust between both partners increases there is an acceptance to take risks and become more committed to a collaboration (Inkpen and Currall 2004).

Learning by one partner would involve the sharing of tacit and explicit knowledge (Polyani 1958), and integral to this learning would be the assessment of the other partner's trustworthiness (Inkpen and Currall 2004). In the case where the non-learning partner demonstrates good project performance may result in an increase in trust and hence the learning partner allowing the other firm to undertake more project tasks.

In such a scenario, Das and Teng (2001) observed that even though risks related to opportunistic behaviour by other partner(s) may reduce, this in turn may also result in an increase in partner reliance for the learning partner. Hamill (1991) noted further that this reliance would be unilateral rather than bilateral. The decision to make such a move could also be deemed a risk, as operational control by and large may be taken out of the hands of learning partner's hands. Das and Teng (2001) call this a 'performance risk'.

Central to the increase in interorganisational trust would see the use of social controls, predominantly at the request of the learning partner (Inkpen and Currall 2004). Sohn (1994) has argued that social knowledge can be utilised as a mechanism for social control in place of some formal controls.

Social control is viewed by Larson (1992) as entailing self-regulation that exercises moral decisions where control is jointly determined and executed through a number of personnel. As such, social control is viewed by Larson (1992) as the 'glue' that brings together freedom and control required for collaboration. Further to this, it is believed that social control provides a balance between freedom and control and delivers successful collaboration, which if not achieved, results in asymmetries in power, trust and learning as outlined.

Considering the impact of social control on trust, conceptual research conducted by Das and Teng (1998, 2001) outlined that social control in the form of shared norms, values, culture, belief systems and preferences have a positive impact on affective (goodwill) trust. The same items and processes

that promote consensus building are noted as providing a base for developing cognitive (competence) trust (Das and Teng 1998, 2001).

Given the promotion of cognitive and affective trust through social control, in a mutual, reinforcing manner, it is likely that the trustworthiness of partners would mainly be based on ability, integrity and benevolence (Mayer, Davis and Schoorman 1995) in choosing the most appropriate ways to execute project tasks effectively in the best interests of all partners.

Whilst the propositions outlined from Inkpen and Currall (2004) are listed in two categories, it should be noted that learning about partners may lead personnel to continuously learn new things about the working practices utilised by the other partner(s) also. As such, one form of learning (learning about a partner) may lead to another (learning by one partner) in an evolutionary manner.

Comparing the types of trust observed using Inkpen and Currall's (2004) propositions with those identified in the trust development taxonomies and models considered in the previous sub-section there appears to be some similarities. Lewicki and Bunker (1996) for example outline that affective trust would be evident in the more mature phases of a relationship and this has certainly been evidenced particularly where social controls may be utilised between partners as noted by Inkpen and Currall (2004). Nielson (2004) also observed that calculus, deterrence based trust may be evident at this phase and again where learning asymmetry occurs, partners may resort to using this form of compliance based trust to control opportunistic behaviour.

2.4.2.4.1 SME PERSPECTIVE:

The propositions as identified by Inkpen and Currall (2004) will be considered from an SME perspective to offer some insight into the relationships between trust, control and learning in small to medium enterprises.

- When learning about a partner takes place this may reduce the need for formal project controls (Inkpen and Currall 2004).

When investigating the learning processes of SMEs, Zhang, MacPherson and Jones (2006) provide some insight into how such companies may undertake this task. For SMEs, triggers such as competitive pressures and a crisis or failure may force an SME to acquire new knowledge. It was observed that more innovative small firms appeared to undertake such a task in a proactive manner compared to the stable (less innovative) companies who waited until faced by the need to change (Zhang, MacPherson and Jones 2006).

Given the manner in which the two types of SME work, it is also worth noting how this impacted on the learning processes utilised. For stable SMEs, learning was confined to a small number of individuals; such as the owner-manager and small number of senior personnel, utilising an informational mode (explicit codified knowledge) where learning required small adjustments (adjustive learning) to organisational norms and systems. For innovative SMEs, learning was found to involve groups of personnel, utilising both informational and interactive modes of learning where individuals exchanged both information and met face-to-face with other companies (Zhang, MacPherson and Jones 2006). As such, this type of SME is more likely to learn more about their collaborative partners than the stable (less innovative) SMEs, through face-to-face social interaction, and through the exchange of both explicit and tacit knowledge.

The learning undertaken by the more innovative firms observed in the sample of the aforementioned research was termed ‘changed values’ as the learning was based on accessing knowledge from collaborating partners and had the impact of changing the values of their firms (Zhang, MacPherson and Jones 2006).

Where partners are not known to each other, calculus trust (Lewicki and Bunker 1996) may evolve into cognitive trust (Lewis and Weigert 1985) where learning about a partner would help them to make predictions of how each partner would execute project tasks. Affective trust may also be

utilised, which may facilitate the sharing of tacit knowledge (Holste and Fields 2010).

One trust based prerequisite for learning identified by Florin and Tell (2004) early in collaborative relationships in SMEs is reciprocity, and if exercised between personnel this enabled them to get to a position where both partners would practice the exchange of knowledge with each other for mutual benefit.

The trustworthiness of partners would then be based on ability and integrity (Mayer, Davis and Schoorman 1995) in choosing the most appropriate ways to execute project tasks effectively in the best interests of all partners. The trust antecedent of benevolence (Mayer, Davis and Schoorman 1995) may also be demonstrated by one partner prior to the other sharing tacit knowledge when for example making practical demonstrations.

- Learning by one partner (e.g. through knowledge acquisition) which results in a shift in bargaining power, may reduce trust and lead to formal project controls being utilised (Inkpen and Currall 2004).

The situated nature of learning of SME owner-manager has a number of characteristics that influences the way they undertake learning. They often lack time and resources for proactive learning, a view shared by many authors (Florin 2003, Ghobadian and Gallear 1996). While functionally isolated, the scope of the role is vast and hence problem solving requires the SME owner-manager to exercise reflexive observation and consider multiple viewpoints, thereby putting them under more pressure than senior personnel in large companies (Florin 2003).

The situated nature in learning approach adopted by SME owner-managers has advantages and disadvantages for their companies.

The SME owner-manager is known for undertaking a number of roles within their company (Florin 2006). This broad view of their company activities makes them ideal for negotiating with potential new partners as they are

acutely aware of their own strengths and weaknesses. In addition, acting like a boundary spanner (Tushman 1977) the owner-manager may share specific pieces of knowledge that he or she picks up from dealing with customers to personnel within the company.

Invariably, the multiple roles adopted by an SME owner-manager sometimes reflect their desire to control certain key functions within their companies (Choran 1969). In this scenario, key pieces of knowledge may not be shared with personnel as the owner assumes they don't need to do this. While adopting this approach to working, may result in not having the time to learn any issues to any great depth, which may inevitably lead the owner-manager to utilise a superficial learning approach (Florin 2003).

The owner manager may practice learning with no, or very few personnel where their views may often be suppressed (Florin 2003). Any biases held by personnel who are collaborating with external companies such as the owner-manager, may also be promoted internally within the company.

In research conducted by Zhang, MacPherson and Jones (2006) it was observed that for stable (less innovative) SMEs, the owner typically engaged in collaborations and for more innovative SMEs, more key personnel engaged in collaborations with other companies. Consequently, given the situated nature of the learning process of the SME owner-manager outlined, it is envisaged that for less innovative SMEs there may be no or very little asymmetric learning taking place. Conversely, the impact of asymmetric learning from more innovative SMEs may be greater and therefore asymmetric learning will only be considered from the perspective of more innovative SMEs. This deduction is proven to be broadly founded in that Bougrain and Haudeville (2002) identified that R&D capacity such as a drawing office function, increased an SME's ability to successfully cooperate with external partners. In addition to this, more recent research conducted by Rezaei, Ortt, and Trott (2015) found that R&D partnerships were found to increase SME firm performance. If however, asymmetric learning undertaken for a given length of time by one partner, then it is anticipated that this may

result in a reduction trust and introduction of formal project controls by the other partner (Inkpen and Currall 2004).

In this scenario, one member of an SME firm may typically work alongside another a person from another collaborating firm, typically a larger company, to gain an understanding of new explicit knowledge, expertise and to sense the way specific forms of tacit knowledge are utilised (Eraut 2004a). These work shadowing activities may help the learners to develop their capacity to be receptive to other's perspectives (receptive capacity) and confront the other company with their own explicit and implicit perspectives (confronting capacity) (Florin and Tell 2004).

The prerequisites for learning at this stage, receptive capacity and confronting capacity (Florin and Tell 2004) of the collaborative relationship when exercised by one partner may provide the other firm with an indicator as to the partner's level of development.

Awareness of learning asymmetry by one partner may result in a reversal in the position of trust from cognitive and affective trust (Lewis and Weigert (1985) to that of calculus trust (Lewicki and Bunker 1996). Trust antecedents utilised to achieve this reversal of trust may be based on low integrity, and benevolence (Mayer, Davis and Shoorman 1995).

Asymmetry of learning may also result in asymmetry of trust (Wang, Peverelli and Bossink 2015). The reduction in trust may be more evident when the learning partner may not be contributing any core skills, which in term may result in formal controls being implemented by the other firm (Inkpen and Currall 2004).

Research conducted by Hamel (1991) has observed that learning by one partner can increase independence. If however a commitment is made to a longer term joint venture this can lead to varying levels of dependence for SMEs. When investigating joint venture relationships, Sheppard and Sherman (1998) distinguished between shallow and deep dependence and

how this impacts on trust and risk. In the case of shallow dependence, risks entailed two key risks of unreliability where for example a supplier might follow quality procedures and discretion where a partner may be required to not divulge sensitive information. In order to mitigate these risks, trustworthiness based on a partner's competence, reliability and discretion may be sought (Sheppard and Sherman 1998).

In the case of a joint venture relationship where deep dependence develops, risks of cheating, abuse, neglect and negative self-asteem may take place. In this scenario, Sheppard and Sherman (1998) for example note that asymmetry in knowledge may take place where such knowledge may be used for competitive advantage. In order to mitigate related opportunistic behaviours, trustworthiness behaviours based on integrity, concern and benevolence may be required.

Deep dependence may also be characteristic of joint venture relationships that take place between large companies and SMEs, where the large company's behaviour may be difficult to monitor (Inkpen and Currall 2004). In such a scenario, the authors note that the larger company may invest in the smaller company, with a view to buying it and therefore the future of the SME would ultimately be in the hands of the larger partner.

- Learning by one partner, which leads to increased dependence by the learning partner may increase the desire for social controls (Inkpen and Currall 2004).

  In asymmetric collaborations a large company may learn about the knowledge and experience of key staff (Eraut 2004a) of an SME, whilst working with them. Typically, this form of learning would involve the sharing of both tacit and explicit knowledge and this would provide the learning (larger) company with the ability to assess the non-learning (SME's) trustworthiness (Inkpen and Currall 2004). In the case where the SME demonstrated good project performance, result in an increase in trust and

hence lead to the large company allowing the SME to undertake more project tasks.

As interorganisational trust increases between the two partners, the learning (large) company may request social controls to be utilised by their partner who may be an SME (Inkpen and Currall 2004).

When investigating softer forms of governance controls in entrepreneurial firms, Larson (1992) outlined that social controls were promoted within partnering firms through establishing the norms of fairness, honesty and reciprocity. These norms imposed expectations and obligations, which were promoted through for example, the following behaviours:

- Confidence that a partner would not be exploited.
- One partner would give the other time to adjust to changes in circumstances rather than be quickly replaced by another supplier.
- Reputation and identity were used as a form of control where behaviours were linked to social and economic exchange and any deviation of routine operations may call into question the integrity of a partner.

  Knowledge sharing mechanisms that may help SMEs promote social controls are primarily through word-of mouth, personal networks and informal socially mediated forms of networking such as lunch breaks and social networks (Boh 2007, Zhou, Wu and Lou 2007). When investigating the working practices of SMEs, Florin (2006) noted that owner-managers had a preference to use soft information such as gossip as opposed to hard data in reports. While, working practices are vastly different from one organisation to the next regardless of size, there may be some truth in this observation.

  Considering the impact of social control on trust as observed by Das and Teng (1998, 2001), it is envisaged that the norms of fairness, honesty and reciprocity promoted through social control will facilitate the

development of both affective (goodwill) and cognitive (competence) trust.

Given the central roles of identity and reputation as mechanisms in promoting social control as noted by Larson (1992) it is likely that that the trustworthiness of partners will be based primarily on integrity, followed by ability and benevolence (Mayer, Davis and Schoorman 1995) when counting on partners to execute project tasks to a required standard.

- Trust will act as moderator between shifts in bargaining power and collaborative relationship stability (Inkpen and Currall 2004).
  As noted thus far, collaborative relationships characterised by low trust may lead to low knowledge sharing between partners, and relationships characterised by high trust may see the free flowing exchange of knowledge. Trust can therefore be regarded as a key variable that provides access to knowledge (Inkpen and Currall 2004).

  In collaborative relationships, typically where a large company works with an SME, knowledge spillovers most likely will occur, which may subsequently result in a smaller company developing competitive advantage. A knowledge spillover is the unintentional spillover of some form of valuable knowledge by a firm to another which results in competitive advantage (Cohen and Levinthal 1990).

  Knowledge spillovers are considered in the case of SMEs as it is thought that this scenario demonstrates the dynamic nature of asymmetric collaborative relationships between a large company and SMEs. While it is acknowledged that a number of factors may contribute to the spill over of knowledge such as informal networks and movement of labour, Audretsch and Keilbach (2007) have observed that entrepreneurs themselves act as conduits to the spill over of knowledge, when working in high knowledge contexts, which may subsequently lead to the creation of new firms.

In the case of high trust, partners may choose not to use detail contracts and may be tolerant of shifts in bargaining power between the companies (Gulati 1998). It may be that initially a detailed contract may be in place; however neither company chooses to exercise the more detailed clauses that exist within it. In this scenario, the relationship may be deemed to be stable. Conversely, when low trust exists between partners, opportunistic behaviour may be evident, which may impact on power asymmetry (Gulati 1998). Clearly, in this situation the relationship could be regarded as instable where one or both partners may install project controls to further mitigate competitive behaviours.

Comparing the types of trust observed using Inkpen and Currall's (2004) propositions with those identified in the SME trust development taxonomies and models considered in the previous sub-section there appears to be some similarities. In their model, Dowell, Morrison and Heffernan (2015) found that in the more mature phases of relationship of SMEs, cognitive trust was dominant. When considering Inkpen's propositions it was observed that cognitive trust may be developed where learning about partners would help them to make predictions of how each partner would execute project tasks. Secondly, when promoting social controls, Das and Teng (1998, 2001) outlined that this may facilitate the development of cognitive trust as well as affective trust.

2.4.2.5 RELATIONSHIP CONCLUSION

Activities covered within this phase relate to those where personnel would reflect collectively together and review the lessons learned on a project or programme. Such activities are given different names by engineering companies; they may be called post project reviews, project evaluations, or project post mortems (Collier, DeMarco and Fearey 1996).

Other than collective reflection itself, example topics identified that are similar include reflective practice, reflective discourse and team reflexivity. It is acknowledged that there are numerous other topics that may cover similar activities; however for this review these areas will be considered.

Quite often where collective reflection is referred to the term reflexivity is used. Luhmann (1995) contrasts the two concepts where reflection is said to take a high level perspective of 'poly-contextual' world view and reflexivity is said to take 'mono-contextual' inward looking world view. As such, reflection is more high level and has a short to medium term focus and reflexivity is more inward looking and has a long-term focus.

Cited benefits of team reflexivity have been identified by Schippers, West and Dawson (2015), who discovered that this item was found to be positive related to team innovation and promotes consensus in decision making as identified by Schippers, Edmondson and West (2014) and Walsh (2009).

Cobb et al. (1997) provides more specific details of what activities may be executed in collective reflection type activities, where he investigated the classroom discourse and mathematical development of a mathematics teacher and students. In this research, collective reflection is characterised by reflective discourse which is undertaken to develop students' understanding of particular mathematical concepts and broader issues related to mathematics through shifts in discourse.

More recent research by Rantatalo and Karp (2016), when studying the reflective practices of policemen in Sweden developed a model of collective reflection, which embodies three types or classifications of collection reflection based on depth of reflection and level of interaction (other regulated or co-regulated social space). The types of reflection formulated with examples are as follows:

- Specular Collection Reflection executed by one person, which is characterised by a low degree of interaction level and a high degree of depth, which could be one person addressing a number of people or team.
- Dialogic Collective Reflection, executed by two people, which would be characterised by a medium level of interaction and depth, such as sharing of viewpoints.

- Polyphonic Collective Reflection, executed by a group of individuals, which would feature a high degree of interaction and low degree of depth. One example of this may be reaching a common consensus on complex issues.

It is worth noting here that within this research Rantatalo and Karp (2016) do comment broadly on peoples' behaviours but do not consider trust. This however is not surprising, given that trust related issues may be rather complex and difficult to conceptualise in these three scenarios. It may however be possible to consider the mode of communication activity and generalise about dominant forms of trust. For example in all forms of collective reflection, institutional trust (Zucker 1986) may be exercised as to what is communicated, while more specific forms of trust such as calculus, cognitive and affective trust (Lewis and Weigert 1985, Lewicki and Bunker 1996) may be utilised for specular and dialogic forms of collective reflection. Calculus and cognitive trust may also be utilised when sharing explicit knowledge that has broader meaning in all forms of collective reflection.

Given that trust has an important role in mediating social relations (Luhmann 1995), when reflecting in open forum with others, it can be said that individuals are making themselves vulnerable (Mayer, Davis and Schoorman 1995). Therefore it is logical to consider trust within the context of collective reflection. Bernade (2018) agrees with this and argues that critical reflective practice is impossible in the absence of trust.

Conceptual research that has investigated the relationship between trust, team reflexivity and knowledge integration by Sankowska and Söderlund (2015) consider reflexivity as a concept that links human behaviour to the utilisation of knowledge. More specifically, the authors define reflexivity '*as an ongoing process of reconsidering perceptions, meanings of human behaviour and language, the suitability of one's own and external knowledge, the scope of assignment and the identification of knowledge gaps that require new knowledge'* (Sankowska and Söderlund 2015).

Based on the notion of task reflexivity (Wong, Tjosvold and Su 2007), Sankowska and Söderlund (2015) propose that reflexivity has a technical aspect or 'technical reflexivity' and social aspect, termed 'social reflexivity'. Based on these two forms of reflexivity, Sankowska and Söderlund (2015) formulate a model that proposes that the perceived value of assignment of a piece of work will be a moderator between trust and reflexivity. While the authors' model considers four propositions for low/high trust and low/high technical and social reflexivity, for brevity the two extremes will be considered as follows:

- High trust and high value of perceived value of assignment will result in the development of their role, creation and application of new knowledge that leads to deep state of reflection to further understand a situation from a social and technical perspective (Sankowska and Söderlund 2015). This appears to be similar to double loop learning as originally proposed by Argyris and Schön (1974) and Argyris (1999). Given that both forms of reflexivity would be exercised this would result in the codification of tacit knowledge into explicit knowledge (Polyani 1958), which may be achieved through ability and benevolence trust antecedents (Mayer, Davis and Schoorman 1995) that are activated through cognitive and affective trust (Lewis and Weigert 1985).
- In the case of low trust and low value of perceived value of assignment, an individual and possibly some team members may view the work as a low priority from both a social and technical perspective. This position may be purely because the work is deemed as low value, in which case this may be part of company protocol exercised through some form of institutional trust (Zucker 1986). If however there is some politically motivated reason for this stance this may be based on calculus trust (Lewicki and Bunker 1996).

2.4.2.5.1 SME PERSPECTIVE

Birk, Dingsoyr and Stalhane (2002) have noted that collective reflection type activities such as project post mortems are excellent initiatives for getting individuals to realise what they have learned on a project and share their experiences with other project groups. The authors note further that project post mortems are also good ways of capturing and sharing experiences for SMEs who

generally cannot afford to invest in large knowledge management programmes. von Zedtwitz (2002) has however observed that companies who conduct R&D projects, in some instances may not have time to conduct such initiatives. As a consequence it is noted by the author that many companies give away opportunities to build competence as project post mortems provide an opportunity to conduct inter project learning and improve performance in subsequent projects.

Similar activities to project post mortems and post project reviews are design reviews, which are typically conducted by SMEs with their customers, who may be a larger company or Original Equipment Manufacturer (OEM).

From an SME perspective it is anticipated that the propositions on trust and perceived value of work assignment as formulated by Sankowska and Söderlund (2015) may also apply. The rationale for this decision is based on the fact that the economies of scale exhibited by a smaller company set-up by and large may not make the propositions work in a different manner. However given that the culture in SMEs is heavily influenced by their owner-managers as noted by Ghobadian and Gallear (1995), and culture has been noted to be linked to institutional trust (Zaheer and Zaheer 2006), then this form of trust may have a greater impact on the perceived value of work assignment for SMEs.

2.4.3 SUMMARY OF FINDINGS FOR PHASES OF COLLABORATION

Summary of the findings from this sub-section are as follows:

- Based on a review of a number of models that consider the development of collaborative relationships in phases, a four phase classification suitable for application in this research has been identified.
- For the relationship formation phase, generally trustworthiness acts as a moderator for company identification and selection.
- For the relationship implementation phase, trustworthiness cues may be used as a means for negotiation. When delivering a contract, trust may be used as a moderator of control, coordination and hence determine the extent to which project controls are utilised.

- For the relationship evolution phase, in collaborative relationships partners may typically learn about their other partner which may increase trust and reduce the need for project controls. Learning by one partner (learning asymmetry), where trust may moderate shifts in bargaining power and the stability of the collaborative relationship.
- For the relationship conclusion phase, collective reflection type activities may take place at the individual, collective or group levels termed specular, dialogic and polyphonic collective reflection. It is noted that the degree to which the social space is regulated is greater at the individual level and lower at the group level. Trust is also noted as having a proportional relationship with the perceived value of task assignment relative to the depth of reflexivity from a social and technical perspective.

From an SME perspective, notable aspects of modern practices that influence trust development are as follows:

- At the relationship formation phase, the timing of involvement of SMEs may typically result in causal ambiguity of knowledge been shared. Trustworthiness is moderated by causal ambiguity of knowledge shared between collaborating partners.
- At the relationship implementation phase, trust asymmetry may be evident when smaller companies collaborate with large companies who may be deemed to be more powerful.
- At the relationship evolution phase, learning by one partner (learning asymmetry) may be conducted by more innovative SMEs which may consequently lead to increased or decreased dependence on their partner who may be a larger company or OEM.
- More innovative SMEs may engage in meaningful collective reflection activities but these may not be on a regular basis. In addition to this it is noted that collective reflection type activities may be done most often by the owner manager and more senior personnel in the company.

Tables 9 and 10 summarise the findings for sub-section 2.4.2 outlining the key forms of trust utilised at the relationship formation, implementation, evolution and conclusions phases. Table 9 considers the general position, which may be regarded as relevant to large companies and Table 10 for SMEs.

Table 11 lists the knowledge sharing mechanisms that may be used by both large companies and SMEs for all relationship phases. Note that the knowledge sharing mechanisms are based on those mechanisms outlined by Prencipe and Tell (2001), Chai, Gregory and Shi (2003), Eraut (2004a) and Boh (2007).

	RELATIONSHIP PHASES			
	RELATIONSHIP FORMATION	RELATIONSHIP IMPLEMENTATION	RELATIONSHIP EVOLUTION	RELATIONSHIP CONCLUSION
Description	Company Identification and Selection	Contract Negotiation and Development	Workplace Learning (Informal Learning) Learning about a Partner (1) Learning by one Partner (2a, 2b)	Collective Reflection Specular (1),Dialogic (2), Polyphonic (3)
Knowledge Types	Explicit and Tacit	Explicit and Tacit	Highly Tacit and Explicit	Tacit and Explicit
Trust Types	Institutional Trust (Generalised Morality)	Calculus Trust	Calculus Trust	Institutional Trust
	Cognitive Trust	Cognitive Trust	Cognitive Trust	Calculus Trust (1,2)
	Affective Trust	Institutional Trust	Affective Trust	Cognitive Trust (1,2)
	Calculus Trust			Affective Trust (1,2)
Trust Antecedents	Ability	Ability	Ability	Ability
	Competence	Integrity	Integrity	Benevolence
	Credibility	Benevolence	Benevolence	
		Credibility	Transparency (2a)	
			Receptivity (2a)	
Function of Trust	Mediator for Company Reputation	Trustworthiness Cues	Reduction in Formal Controls (1)	Proportional relationship with Perceived Value of Task Assignment relative to depth of Technical and Social Reflexivity
		Moderator of control, coordination and extent of contract	Lead to Formal Controls (2a) Skill Convergence (2a) Trust Asymmetry (2a)	
		Moderator of control mechanism and indirect Moderator of Control Level	Social Control (2b)	
Additional Notes:		Identification Trust where partners are known really well	Affective and Cognitive Trust facilitates the sharing of Tacit Knowledge	Collective reflection is inversely proportional to the degree to which the social space is regulated
		Communication media is important for effective negotiation outcome	2a Learning by one partner that leads to a shift in Bargaining Power	
			2b Learning by one partner that leads to increased dependence and Social Controls	

Table 9: Summary of Collaborative Relationship Phase Trust Characteristics

	RELATIONSHIP PHASES			
	RELATIONSHIP FORMATION	RELATIONSHIP IMPLEMENTATION	RELATIONSHIP EVOLUTION	RELATIONSHIP CONCLUSION
Description	Company Identification and Selection	Contract Negotiation and Development	Workplace Learning (Informal Learning) Learning about a Partner (1) Learning by one Partner (2a, 2b, 2c)	Collective Reflection Specular (1),Dialogic (2), Polyphonic (3)
Knowledge Types	Explicit and Tacit	Explicit and Tacit	Highly Tacit and Explicit	Tacit and Explicit
Trust Types	Affective Trust	Calculus Trust	Calculus Trust	Institutional Trust
	Cognitive Trust	Cognitive Trust	Cognitive Trust	Calculus Trust (1,2)
		Institutional Trust	Affective Trust	Cognitive Trust (1,2)
		Cognitive Trust Asymmetry		Affective Trust (1,2)
		Affective Trust Asymmetry		
Trust Antecedents	Integrity		Reciprocity (1, 2b)	Ability
			Ability	Benevolence
			Integrity	
			Benevolence	
			Receptive Capacity (2a) Confronting Capacity (2a)	
			Fairness (2b) Honesty (2b)	
Function of Trust	Trustworthiness is moderated by Causal Ambiguity	Trust and Power Asymmetries from outset	Reduction in Formal Controls (1)	Proportional relationship with Perceived Value of Task Assignment relative to depth of Technical and Social Reflexivity
		Trust threshold	Lead to Formal Controls (2a) Trust Asymmetry (2a)	
			Social Control (2b)	
			Moderator of shifts in Bargaining Power & Relationship Stability (2c)	
Additional Notes:	Timing of Involvement of Suppliers may lead to Causal Ambiguity of Knowledge	Unified culture of SMEs may influence Institutional Trust	2a Learning by one partner that leads to increased Bargaining Power	Unified culture of SMEs may influence Institutional Trust
	In absence of Calculus and Cognitive Trust, Institutional Trust may lead to Affective Trust being used early in a relationship	Asymmetric nature of collaboration	2b Learning by one partner that leads to increased dependence and Social Controls	Collective reflection is inversely proportional to the degree to which the social space is regulated
		Moderating effect of Trust mainly applies in the case of Rational Trust	2c Learning by one partner that leads to shift in Bargaining Power and relationship stability	
		Moderating effect of trust may not apply in the case of Trust Asymmetry	Affective and Cognitive Trust facilitates the sharing of Tacit Knowledge	
			Situated nature approach to learning by SME Owner Manager	

Table 10: Summary of SME Collaborative Relationship Phase Trust Characteristics

Knowledge Sharing Mechanism:	Relationship Phase:			
	Relationship Formation	Relationship Implementation	Relationship Evolution	Relationship Conclusion
Virtual Meeting	X	X	X	X
Face to Face Meeting	X	X	X	X
Personal Network	X	X		X
Informal One to One (during work hours)	X	X	X	X
Informal One to One (out of work hours)	X	X	X	X
Email Communication	X	X		
Personal Notes	X	X	X	X
Personal Business Documents	X	X	X	X
Project Database	X	X	X	X
Electronic Data Sharing	X	X	X	X
Inter or Intranet Usage	X	X	X	
Company Documents and Reports	X	X	X	X
Company Procedures and Manuals	X	X	X	X
Meeting Minutes	X	X		X
Community of Practice			X	X
Learning by Doing			X	
Learning by Replication (Copying)			X	
Learning by Reflecting			X	X
Project/Design Reviews and Audits			X	X
Project Evaluations/Post Mortems				X
Mentoring			X	
Informal Brainstorming			X	X
Boundary Spanner Roles	X	X		X
Thinking out Loud			X	X
Intra-Project Lessons Learned Database	X	X	X	X
On the Job Training			X	

Table 11: Typical Knowledge Sharing Mechanisms for Relationship Phases One to Four (Prencipe and Tell 2001; Birk, Dingsoyr and Stalhane 2002; Chai, Gregory and Shi 2003; Eraut 2004a and Boh 2007).

2.5 SUMMARY

Chapter Two has reviewed the main literature areas of trust, knowledge sharing and collaborative relationships. It has been established that trust is a broad ranging concept that has been investigated extensively in a broader number of fields. Specific issues have been identified that promote and inhibit the development of trust and sharing of knowledge in large organisations and SMEs. While considering such issues, it has been noted that trust has been considered as a necessary condition for sharing knowledge, this item has not received attention by researchers when considering the sharing of practical knowledge.

A review of the literature on practice based theories has revealed different schools of thought as to how practical knowledge can be shared and the issues faced by companies in their daily operations. While trust has been widely acknowledged in the literature as being important, it would appear that no research has been undertaken of how it influences the sharing of practical knowledge.

Based on a review of a number of models that consider the development of collaborative relationships in phases, a four phase classification for application in this research has been developed. For each relationship phase, specific issues related to trust and knowledge sharing have also been identified, where knowledge is considered as a two dimensional (i.e. explicit and tacit) concept. However to date, no academic research has been undertaken that investigates the influence of trust and sharing of practical knowledge as a multi-dimensional concept such as that proposed by Guzman (2009). In doing so it is envisaged that such research would provide a better, more informed understanding as to how both items interact together.

In order to address the aforementioned gap in the literature, it is proposed that three research questions should be posed that provide evidence of the following items using the typical collaborative activities in the four relationship phases identified as a focus.

- Given that an organisation's culture is one of the main factors that influence the trust and knowledge sharing behaviours of collaborating partners, the research should look to characterise a practical knowledge sharing culture.
- The specific perceptions and experiences of how engineering practitioners form collaborative relationships, and the role of trust in realising such relationships.
- Specific insight into how trust is developed in collaborative relationships and the different forms of practical knowledge shared by engineering practitioners.

CHAPTER THREE
INVESTIGATING TRUST AND PRACTICAL KNOWLEDGE SHARING IN TECHNOLOGY PRODUCING SMEs

3.1 INTRODUCTION

Chapter Three outlines the research philosophy, paradigm, methodology and associated methods used to both collect and analyse the primary and secondary data produced by the research.

Presented also in this chapter is the justification for the methods used to both collect and analyse the data and associated processes. Limitations of the research design are then presented along with details of how ethical and consensual issues have been addressed by this research.

For reflective purposes, the three research questions are outlined as follows:

1 What are the main characteristics of a trust based practical knowledge sharing culture within the sample of SMEs and large companies?

2 What are the specific perceptions and experiences of engineering practitioners who adopt trust based strategies for sharing practical knowledge for each collaboration relationship phase?

3 What are the specific perceptions and experiences of engineering practitioners that demonstrate how trust is constructed and how this influences the way practical knowledge is shared for each collaborative relationship phase?

For research questions two and three, the following collaborative relative phases and activities are considered:

- Relationship Formation: Partner identification, selection and initial trust building.
- Relationship Implementation: Contract negotiation and development.
- Relationship Evolution: Informal learning.
- Relationship Conclusion: Collection Reflection.

3.2 RESEARCH PHILOSOPHY AND PARADIGM

The basic beliefs of research are often referred to as world-views (Cresswell 2009) and are often referred to as ontologies and epistemologies (Crotty 1998) and paradigms (Lincoln, Lynham and Guba 2011). Ontology is a particular understanding as to 'what is' and epistemology a particular understanding as to 'what it means to know' (Crotty 1998).

In the context of this research as a social constructionist epistemology has been adopted, as it is argued that both ontological and epistemological items emerge together (Crotty 1998), and therefore it is not necessary to outline ontology separately.

The most common epistemologies sited within the literature are positivism (objectivism) and constructionism (interpretivism). Objectivism is defined by Crotty (1998) as a conception where *"meaning and therefore meaningful reality exists apart from the operational consciousness".* Constructionism on the other hand is viewed as a more subjective conception where people construct meaning in different ways (Crotty 1998). It is noted that the most common conception used by scholars has been that of objectivism.

Social constructionism therefore advocates that meaning is constructed rather than discovered and engage with the world they are interpreting (Crotty 1998). As a consequence, by adopting this stance it is acknowledged that people draw meaning from different constructs through reasoning. In line with this view, Berger and Luckmann (1967) outline that meaning emerges through social interaction rather than being considered to be in existence and therefore ready to be discovered.

In the context of this research, while the outcome(s) of trust based collaborative relationships can be new innovative products or processes, this may not fully reflect what happens in practice. This is primarily due to the fact that knowledge sharing is influenced by a broad number of factors such as economic, social and culture thereby making it unique from one company to another and even personnel within the same company. For example the identification and selection

of suppliers for a piece of equipment by a large company may be seen as a much smaller and easier task to fulfil compared to the same task being fulfilled by an SME.

Social constructionism argues that knowledge is socially constructed and therefore within the context of this research, trust based practical knowledge sharing between all organisational personnel is delivered through social processes.

3.3 RESEARCH METHODOLOGY

In this sub-section the methodology and methods used to conduct the research are outlined with justification for their selection where appropriate.

3.3.1 QUALITATIVE METHODOLOGY

A qualitative strategy was adopted to investigate the various ways trust based collaborative relationships are utilised in large companies and SMEs. In doing so, the aim was to gain an understanding of how trust based working influences the development of collaborative relationships over the life of a project.

Data was collected using semi-structured one-to-one interviews and participant observation and. Six people participated in the research, three of which worked in large companies and three in SMEs. The unit of analysis used was short stories or anecdotes.

When considering various methods for collecting qualitative data, it was thought that such a method should be flexible and allow the research to explore participants' thoughts, feelings on a topic and examine specific issues more deeply. DeJonckeere and Vaughn (2019) outline that semi-structured interviews provide the aforementioned characteristics and further comment that they are the sole data source for a qualitative study.

Two other methods of data collection that were considered but later discounted were focus groups and structured interviews.

Focus groups were considered as it was initially thought that the views of both the trustor and trustee from a group of individuals who have worked on the same projects could be collated. In doing so, the research could take advantage of the main strength of focus groups by providing insight into the complex behaviours and motivations of participants (Morgan and Krueger and 1993). Limitations reported of focus groups, include the researcher has limited control over the data produced and interaction of participants other than keeping them focussed on a topic (Morgan 1996). The systematic analysis of focus group transcripts is also more complex and time consuming than one-to-one interviews (Gill et al. 2008).

Structured interviews were also considered as these provide a means to collate responses in a consistent manner (Mathers, Fox and Hunn 1998). This approach however, looks to 'verbally pin' the respondent down where the researcher may be deemed to ask questions in a confirmatory manner (Leech 2002).

In considering focus groups and structured interviews, it therefore became evident that a middle-ground approach should be adopted, which would help the research to elucidate tacit knowledge from participants. By using a semi-structured approach, it was decided that ethnographic interviews should be employed where anecdotes are co-constructed by both the participant and researcher. By using such a method, both individuals (i.e. interviewer and interviewee) develop a common sense of awareness and reflect together on how each question is approached, discussed and the responses are produced (Heyl 2010).

The literature also appears to support the use of anecdotes (short stories) in their ability to yield tacit knowledge. For example, Martin (1982) has commented that stories are one of the many forms of implicit communication used in organisational contexts. Wilkins and Thompson (1991) have also noted that stories act as an appropriate way for studying tacit knowledge because participants frame their experience in stories.

Given the narrative form of data produced, Narrative analysis has been chosen as an appropriate method for examining the interview transcripts as it considers

what is being said and the way narratives (stories) are told (Hytti 2003). In Narrative analysis, the unit of analysis is typically 'the narrative' (Eriksson and Kovalainen 2008). In this investigation, the unit of analysis is therefore 'the anecdote'.

Participant observation had also been chosen along with semi-structured interviews as the participant, an SME for one case study, along with their collaborating partner a large company, had invited the research project to conduct observations at the large company's site. In ethnographic research, Spradley (2016) comments that it is common to conduct interviews and observations, which provide the researcher with the opportunity to have informal dialogue (informal interviews) with the participant thereby helping to co-construct anecdotes based on the projects undertaken and observe the way both partners work together.

A case study strategy was adopted in this research. Jupp (2006) defines this strategy "as an approach that uses an in-depth investigation of one or more examples of social phenomenon using a variety of sources of data". The aforementioned author also defines a case as an individual person, event, social activity or group. Case studies are also noted to be exploratory in nature (Robson 2002) whilst the case may not represent a world view; it does represent the phenomena studied within the case(s) (Stake 1998).

Stake (1998) categorises case studies into three groups which are called intrinsic, instrumental and collective. Intrinsic case studies are phenomena that are of particular interest to a researcher, instrumental case studies are utilised for research that develops or builds on existing research. Collective case studies are in essence a number of case studies that build on existing research (i.e. a number of instrumental case studies). Since this research is looking to study a number of specific cases that explore how trust is constructed by engineering practitioners when sharing practical knowledge, it is considered that a collective case study strategy is appropriate.

The Case study strategy is also considered to be appropriate for the following advantages, which are considered from Orum, Feagun and Sjoberg (1991):

- The Case study strategy allows the researcher to ground observations and associated concepts in practice (Orum, Feagun and Sjoberg 1991). In this research, the sharing of practical knowledge and associated working practices are considered to be a rich source of data that will enable the researcher to achieve the research objectives.
- Case study research is generally exposed to participants' daily practices, which may facilitate the achievement of innovative research outcomes (Orum, Feagun and Sjoberg 1991): This research considers daily practices from different perspectives thereby enriching the findings of the research. It is however noted that the objectives of this research is not to generalise the research findings, but to demonstrate the validity of the research by providing rich descriptions that can be compared with other similar cases.
- The case study strategy allows research to consider multiple sources of data thereby enabling the researcher to take a holistic research approach (Orum, Feagun and Sjoberg 1991). As the case study permits the use of multiple sources of data to explore trust based collaborative relationships, it is argued that the case study strategy is the most appropriate strategy to use in producing innovative research outcomes.

While the aim of this research is to gain an understanding of how trust influences the sharing of practical knowledge in collaborative relationships, it was felt that the collation of trust based data would provide the research with methodological challenges due to the numerous ways in which trust is enacted in practice. In addition to this, participants' trust strategies may be deemed personal or private and therefore may feel that it may not be appropriate to divulge such information within the context of a research project.

3.3.2 QUALITATIVE ANALYSIS

This research utilises inductive qualitative analysis (Thomas 2006) to explore research questions, which are based on the findings from the literature review. This approach is in contrast to deductive qualitative analysis (Gilgun 2005) where

more specific hypotheses or propositions may be tested. Qualitative research need not support hypotheses or propositions, however having such theories can be in important for qualitative research (Gilgun 2005).

Inductive analysis on the other hand requires that the research begins with an area of study and allows the theory to emerge from the data (Strauss and Corbin 1998). As such, the primary purpose of this form of analysis is to allow findings to emerge from frequent, dominant or significant themes without being restrained by highly structured methodologies (Thomas 2006).

Thomas (2006) outlines a general inductive analysis which is worth highlighting as it outlines the main constituent parts of this form of analysis as follows:

- To condense extensive, raw textual data into a concise format.
- Establish clear links between the research objectives and summary findings and ensure that the links are both transparent and defensible.
- Develop a model or theory based on the underlying structure of experiences that are evident in the textual data.

It is noted that the inductive approach is common in qualitative analysis and comes in several forms. Qualitative data analysis processes that look to identify general patterns in qualitative data have been proposed by for example Miles and Huberman (1994) and Braun and Clarke (2006). A more structured approach is that of Grounded Theory, which appears to be a more common approach used by qualitative researchers in a number of fields along with Analytic Induction as proposed by for example Punch (1998).

As with all qualitative research both inductive and deductive, generalisability of the findings is not assumed but must be tested to see if these are useful in new or different environments (Gilgun 2005). In the context of this research, generalisability is not claimed on the findings that emerge from the data; however such a characteristic needs to be tested in different organisational settings and in doing so establish the level of transferability.

As noted by Thomas (2006) an inductive analysis of findings are summarised as they emerge and links are made with the research objectives. These links may inform the development of more specific propositions, hypotheses or models. The inductive qualitative analysis approach in this research is in line with the approach outlined by Thomas (2006) where themes and specific patterns emerged in the interview data and short stories or anecdotes. These emergent themes and patterns, which embody propositions were subsequently used to formulate a decision making model.

Inductive qualitative analysis is similar to the deductive approach in that the analysis starts with data that defines phenomena in a general manner from which more specific propositions emerge from the data (Hyde 2000). This form of qualitative analysis that utilises deductive reasoning therefore facilitates the refinement of raw data from which new theory emerges.

3.4 PILOT STUDY

In this sub-section the activities required to develop the interview guide and screening questionnaire are outlined with supporting theory.

3.4.1 INTERVIEW GUIDE DEVELOPMENT

Sampson (2004) outlines that pilot studies are to some extent underutilised due to methodological allegiances and pilots tend to be linked to positivist research approaches. Pilot studies allow a researcher to deliver the main research project successfully (Saunders, Lewis and Thornhill 2006).

Prior to conducting the case study research, five postgraduate students were used to develop the research instruments. It should be noted that all students had work experience and therefore interviews were based on projects that were most memorable to them.

Five individual interviews were conducted with each postgraduate student. The primary objective of this study was to assess the suitability of each question and the overall effectiveness of the instrument to collect data (Fontana and Frey 2003).

All five interviews were digitally recorded and transcribed. In addition to this, notes were taken during each interview, which lasted approximately 60 minutes.

For brevity, the main challenges as presented in Table 12 that influenced the development of the interview guide will be discussed. The final version of the interview guide can be found in Appendix D.

• Accurate data capture from the perspective of the trustor and trustee. • Capture of tacit knowledge data. • Capture of cultural data. • The need to capture data on specific activities and general experiences.

Table 12: Main Challenges that Influenced Interview Guide Development

Reflections on the main challenges experienced while developing the interview guide are as follows:

- The first version of the interview guide was designed originally to interview participants separately on their experiences as a 'Trustor' and 'Trustee'. After giving this some thought, it was decided that one person may take on these two roles and 'switch' dynamically during the life of a project. As a result, it was decided to design the interview guide to ask participants to recall on their experience for each collaborative relationship stage in general terms and identify the perspective (i.e. trustor or trustee) when analysing the transcript.
- While interviewing the students it became evident that it would be difficult to capture tacit practical knowledge. Obviously, the student would mainly talk about their experience in explicit terms; however the researcher was mindful to be able to get the participant to talk about more explicit events and tasks that took place. In order to achieve this, the researcher decided to use a two

stage interview process where more general experiences were captured in the first interview and specific experiences in the second interview using questions that facilitated sensemaking (Weick 1995). The sensemaking approach, has been developed in a number of fields, such as psychology (Weick, 1995) and information sciences (Dervin, 1983), essentially employs questioning processes whose aim is to ascertain how people give meaning to their experiences. Upon formulating and trialling some questions with one student it became evident that the approach, while useful would take too much time to develop. At this point it therefore was decided to use one semi-structured interview guide and utilise a more specific conception of tacit knowledge as proposed by Ambrosini and Bowman (2001) where the research would focus on capturing type B, C and D forms of tacit knowledge (see Figure 4).

- While interviewing students it was found that some cultural elements of their experiences were evident, however it was felt that more cultural type data could be extracted by adding a biographical section to the interview guide. This section asks questions about the participant's background using the demographic information in the screening questionnaire as a guide.
- Initially interviews conducted within the pilot focussed on getting the participant to talk about previous projects they had worked on, however it was felt that the research should focus on specific aspects of trust based knowledge sharing. In order to achieve this it was decided that the research should focus on identifying experiences as four developmental phases of a collaborative relationship over the life of a project. In each project phase, the study should consider specific types of working practice such as relationship formation (partner identification, selection and initial trust building), relationship implementation (contract negotiation and development), relationship evolution (informal learning) and relationship conclusion (collective reflection). The main body of the interview guide was then restructured around these phases to get the participant to provide details of experiences of trust based knowledge sharing for each phase.
- When considering the restructuring of the interview guide as outlined previously, it was decided to use a more specific form of unit of analysis in

short stories or anecdotes. It is acknowledged that this had implications for the interview process itself; however it is mentioned here as this was considered when rewording the questions within the interview guide.

Additional questions were added to the interview guide as follows:

- General comment on the achievement of outcomes on some of the key experiences outlined and when outcomes were not achieved what changes were made to improve the mechanisms used to share practical knowledge.
- If a form of tacit knowledge had not been referred to during the course of the interview without being prompted, then a question was posed asking if the participant had experiences where practical knowledge was shared which could not be explained.
- Publicly available documentation for the projects discussed.
- Final questions for the interviewer (i.e. debriefing questions).

A second interview guide was also formulated for follow-up interviews based on the four relationship phases investigated. It was intended to use a second interview to build a detailed picture that would enable the researcher to answer research question three. The final version of the follow-up interview guide can be found in Appendix D.

3.4.2 SCREENING QUESTONNAIRE DEVELOPMENT

Initially it was intended to screen participants by interview due to the need to choose those with the relevant experience that would enable the researcher to capture rich qualitative data. In addition to this, as this research considered issues related to trust, the researcher wanted to ensure that the participant could provide experiences that would provide insight into trust related issues. When considering such issues, it was decided to focus the research effort on the four specific areas of the collaborative relationship classification and this in turn made it easier for the participant to provide concise responses regarding their experiences. As a consequence, it was decided to use a short screening questionnaire which collated a small amount of key demographic data, details of their education and specifically asked the participant to provide example projects

where they had worked relevant to the four collaborative relationship phases as outlined previously. The final version of the screening questionnaire can be found in Appendix C.

The screening questionnaire utilises two sets of classification questions (Oppenheim 1998) to capture demographic (gender and age) information and establish which of the four collaborative relationship phases the participant had working experience in. The remainder of the questionnaire utilises three open ended sets of questions (Oppenheim 1998) to ascertain the details of the participants' education, overview of their current role and specific information regarding their experience. Experiential data collated related to the identification and selection of suppliers, contract negotiation and development, work based learning and collective reflection type activities.

When developing the detail of the screening questionnaire, no specific major challenges were experienced other than the format of the questions were changed where the participants' response was written or typed on a line to a box format. In doing so, it was believed that this improved the overall appearance of the questionnaire.

3.5 SAMPLE DESIGN AND SCREENING

In this research, a purposive sampling strategy was adopted to select participants. It is acknowledged that this strategy is widely used in qualitative research and particularly relevant as it is typically used to identify and select a small number of information rich cases (Patton, 2002). In this research it was also intended to identify and select a number of individuals based on their knowledge of a specific area of interest (Cresswell and Plano Clark, 2011).

It was also envisaged that the research should also aim to identify a number of participants who worked within a broad range of engineering sectors that would provide the research with a good understanding of how trust based knowledge sharing takes place over a spectrum of working practices. In addition to this, the research looked to sample participants who worked in large companies and

SMEs as the research intended to compare trust based knowledge sharing practices from two perspectives.

In the context of this research, larges companies are taken as having 251 or more personnel (EC 2015) and SMEs as having 1 to 250 personnel (EC 2015).

The aforementioned large company and SME definitions are deemed appropriate for this investigation as researchers generally agree that the structure of an organisation impacts on its ability to share knowledge and collaborate. For example, Gold, Malhotra and Segars (2001) comment that companies with flexible structures are more likely to achieve benefits from sharing knowledge than companies that have hierarchical structures. It is however, acknowledged that large companies invariably structure their business to operate like SMEs so they can realise the same benefits. This practice however was not evident in the companies in which participants worked.

A list of companies known to the researcher and colleagues known to the research team was made. Additional companies were also found by internet search and approximately 30 companies were contacted by email where a participant information sheet and screening questionnaire (see Appendix A and C respectively) outlining details of the project were attached.

Participants were chosen mainly on the basis of the quality of their experience in collaborative working with respect to the four areas of interest. It should be noted that the research is interested primarily in the participant and associated experiences that they have primarily from their current role and other historical roles. Experience in collaborative working both within an organisation between functions and between companies was also of interest.

Upon reflection, it is noted that a significant amount of effort was required to secure access to participants due to an initial low response. Eight participants were identified and based on the experience of the candidates and the timeframe required for data processing, six people were chosen to participate in the research. By choosing such a sample it was envisaged that the participants

would provide rich anecdotes (short stories) how trust based knowledge sharing was utilised. In addition to this, it was also envisaged that this would provide the researcher with a broader awareness of how collaborative relationships develop over time.

Table 13 provides an overview of the participants, company names and all other associate data have been anonymised for the purposes of this research. The cases cover individuals and organisations that are located across the UK.

Case Study No:	SME Sub-Group		Case Study No:	Large company sub-group	
	Participant Name:	Company:		Participant Name:	Company
One (CS1)	Alan	Company E	Three (CS3)	Colin	Company J1
Two (CS2)	Brian	Company O	Four (CS4)	Derek	Government Department E
Six (CS6)	Frank	Company G2	Five (CS5)	Elaine	Company F2

Table 13: Overview of Participant Sub-Groups

It was noted that most participants within the two sub-groups were engineers and one participant was a knowledge manager had a broad background in engineering. At the time of the research, one participant (Derek) worked within a government department but had previous experience working as an engineer in a number of large engineering companies.

At the time of the research, Colin, worked for himself as a consultant, however most of his experience related to his time working in large engineering companies and therefore the case is included in the Large company sub-group.

3.6 DATA COLLLECTION

For this research, three methods of data collection were used to capture participants' experiences through narrative discourse. This was achieved by using one screening questionnaire, two stage semi-structured interviews, and participant observation where possible. These methods are outlined by Atkinson et al. (2010) as being commonly used in ethnographic research. By using multiple research methods, Knafl and Breitmayer, (1991) observe that this

provides an opportunity to triangulate, or cross-check data from multiple sources thereby enhancing the trustworthiness of the research outcomes.

Figure 5 outlines the Four Stage Data Collection Process outlining the key aims of each stage.

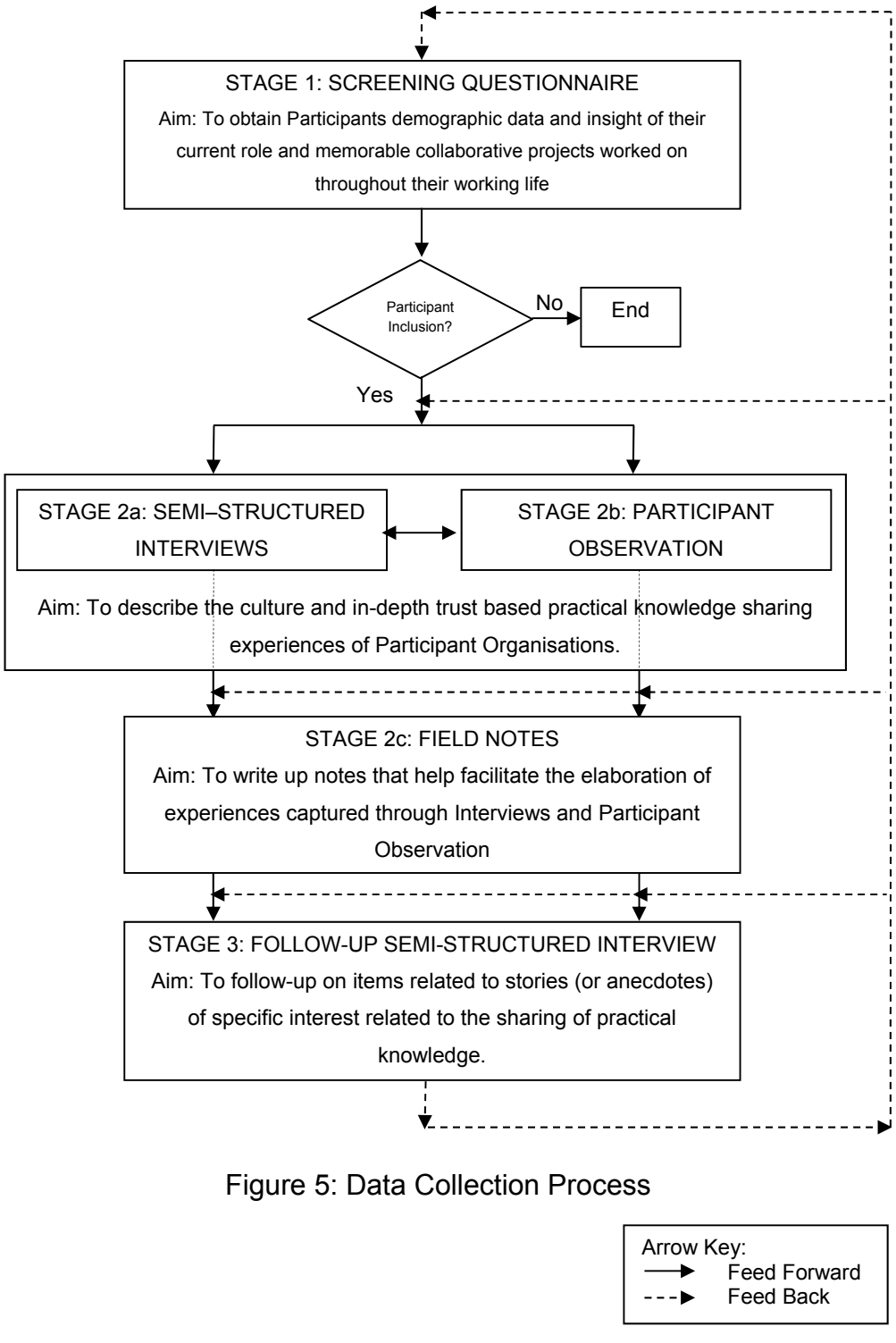


Figure 5: Data Collection Process

3.6.1 SEMI-STRUCTURED INTERVIEWS

It is argued that most qualitative research uses interviews as they allow researchers to access participants' experiences which may be considered too difficult to capture with other methods (Peräkylä and Ruusuvuori 2011). Semi structured interviews are noted by academic researchers to be appropriate when it is required to understand the opinions and beliefs of a participant about some subject matter and the associated constructs that they use (Easterby-Smith et al. 2008). In general terms, interviews can be exploratory, descriptive, or explanatory and provide the researcher with the opportunity to collect research data in an iterative manner thereby enabling them to refine their research instrument (Lee 1999).

In this research, semi-structured interviews were used to collect data from the research participants. Interviews allow the researcher to probe the personal experiences of participants to uncover more vivid accounts that provide fresh insight (Burgess 2003). A predefined number of questions are commonly used which are to typically executed to a schedule (Bryman and Bell 2011). Semi-structured interviews do however provide some level of flexibility as to how the interview questions are posed to the interviewee. This is perhaps one of the greatest strengths of the method as it can be tailored specifically to the meet the needs of the participant, thereby enabling the researcher to maximise the quality of the data produced from an interview.

More in-depth follow-up questions may also be put to the participant in a second follow-up interview. Easterby-Smith et al. (2008) note that such an approach provides purpose and direction to an interview.

While the views of the participant may be captured during the course of an interview, in a bid to direct the line of conversation, the views of the researcher may also be uncovered. In qualitative research this is regarded as being acceptable as this exposes the views of the researcher and therefore contributes to the trustworthiness of the research as noted by Shenton (2004).

Given that this research is looking to understand how trust influences the way people share practical knowledge within a work place setting, a key part of the interview was to get participants to provide descriptive accounts giving insight into cultural related phenomena. Asking participants to tell their accounts as anecdotes helped to achieve this in part, however within the semi-structured interviewing framework, ethnographic interview questions were also utilised as proposed by Spradley (2016). Ethnography is a widely known qualitative research approach that is typically used to make sense of what people say in describing culture from the perspective of the participant (Spradley 2016). At the heart of ethnography is getting to know the world of the participant using research methods such as participant observation in a bid to understand their world and how they learn their culture.

3.6.2 INTERVIEW PROCESS

Before the interview started the researcher asked participants if they had read the participant information sheet, which provides background information on the research project. A research participant consent form (see Appendix B) was then given to participants to read and sign. Participants were then asked if they had any questions prior to starting the interview and asked whether it was acceptable to make an audio recording of the interview with a Dictaphone and at the same time it was stated that their anonymity would be ensured.

Where possible, interviews were conducted in person at the participant's place of work, or by telephone and one interview was conducted at the university.

Interviews were conducted using the interview guide and the participants responses in the screening questionnaire were also used to guide the line of questioning. In addition to asking the participant to provide background about themselves, particular attention was paid to the four main areas of the investigation where the researcher asked each participant to provide anecdotes related to each. Where appropriate, question prompts and probes were used (Oppenheim 1998). In addition to this, descriptive, structural and contrast ethnographic questions (Spradley 2016) were used to provide further depth to

each anecdote. While recalling each anecdote, each participant was also asked to recall memorable or key aspects of each experience which enabled the participant to provide further richness to the data.

During each interview notes were not taken to focus the researcher's efforts on steering the line of enquiry thereby enabling the research to produce accurate rich anecdotes.

In most cases, interviews took approximately 60 minutes with some lasting 90 minutes at the most.

After each interview, reflective notes were made about key memorable aspects of the interview from the researcher's perspective. By making such notes this enabled the research to record each interview and associated activities as an inclusive experience.

After completing the first stage semi-structured interview, the audio file and transcript produced were reviewed to identify areas of interest that should be followed-up in a second semi-structured interview. Follow-up interviews were conducted in a similar manner to the first interview with five out of the six participants, where gaps or inconsistencies were identified in anecdotes related to the four main areas of the research.

3.6.3 OBSERVATION PROCESS

Observations are considered to be a major source of data as they enable researchers to uncover complicated phenomena within a social context (Marshall and Rossman 1999). As a result this form of data collection allows the researcher to observe activities in real time (Adler and Adler 1994). Observations can be conducted in a number of ways; these include participant observation and non-participant observation (Eriksson and Kovalainen 2008). In participant observation the observer is allocated a role thereby enabling them to witness reality as participants do (Marshall and Rossman 1999). The degree to which the observer participates is also established in advance of conducting the exercise with the participants (Marshall and Rossman 1999). The approach adopted

within this research was non-participant observation, where the observer is not allocated a role by the participant organisation and purely observes the participants actions and behaviours within their natural setting (Eriksson and Kovalainen 2008).

Observations were conducted within a large tier one automotive supplier (Company A), where the researcher observed the actions and behaviours of one participant, a contract jig and tool design engineer (Company E) for a period of approximately three working weeks. This allowed the researcher to gain insight into the unspoken or tacit aspects of their work. For example the manner in which engineering designs are reviewed with associated discussions which provide insight into the way trust facilitates the sharing of practical knowledge. Observations also allowed the researcher to witness how participants reflect with others thereby allowing the researcher to see how such an activity interacted with the sharing of practical knowledge and associated sharing mechanisms.

To provide a specific focus, observation notes were taken on specific projects and broader details about the culture of Company A and Company E. Also noted was the manner in which Company A and Company E worked or collaborated together. In essence, observation notes were made in a manner that enabled the researcher to answer the research questions of this investigation. Observation notes related to the sharing of practical knowledge were also taken about informal events such as coffee breaks or lunch breaks, where the researcher interacted with participants informally.

Observations were captured with a digital Livescribe Echo pen, which enabled hand written notes to be converted to text. Previous research such as that conducted by Shipp, (2013) and Martinez, (2016) have also used such a method in their respective research.

It is important to note that observations were conducted with Company A and E only. One of the participants Alan of Company E, gained permission from Company A to conduct the observations at their premises.

3.6.4 FIELD NOTE TAKING

To supplement the interview transcript data, notes were taken by reviewing company websites of participants and making notes on key items that would enable the researcher to answer the three research questions of the investigation.

Notable items reviewed on each company website include the following:

- Strategic company information that would provide insight into the culture of the company, for example company mission, vision and values.
- Company structural information and specific example case study information that would provide details of how the company shared practical knowledge and associated trust related matters.
- Profiles of key personnel and their views on the company, for example the company CEO, which also may provide information related to the company's culture and related operational issues.

It should be noted that the above information was added to the notes made of the interview experience as one field note for each case study.

3.7 DATA ANALYSIS FOR RESEARCH QUESTIONS ONE AND TWO

In this sub-section, the steps presented in Figure 6 were applied to organise and analyse the thematic data in a manner that would enable the research to answer Research Questions One and Two are outlined.

One major feature of the data analysis process is the usage of both Excel and NVivo 11 software to analyse the thematic data.

Initial coding was done in Excel, due to its ability to navigate and manipulate data quickly in large documents. These two functions proved effective when assigning initial codes and research question numbers. Both Meyer and Avery (2009) and Bree and Gallagher (2016) attest to the utility of Excel in its ability to manipulate data effectively when using it to conduct thematic analysis.

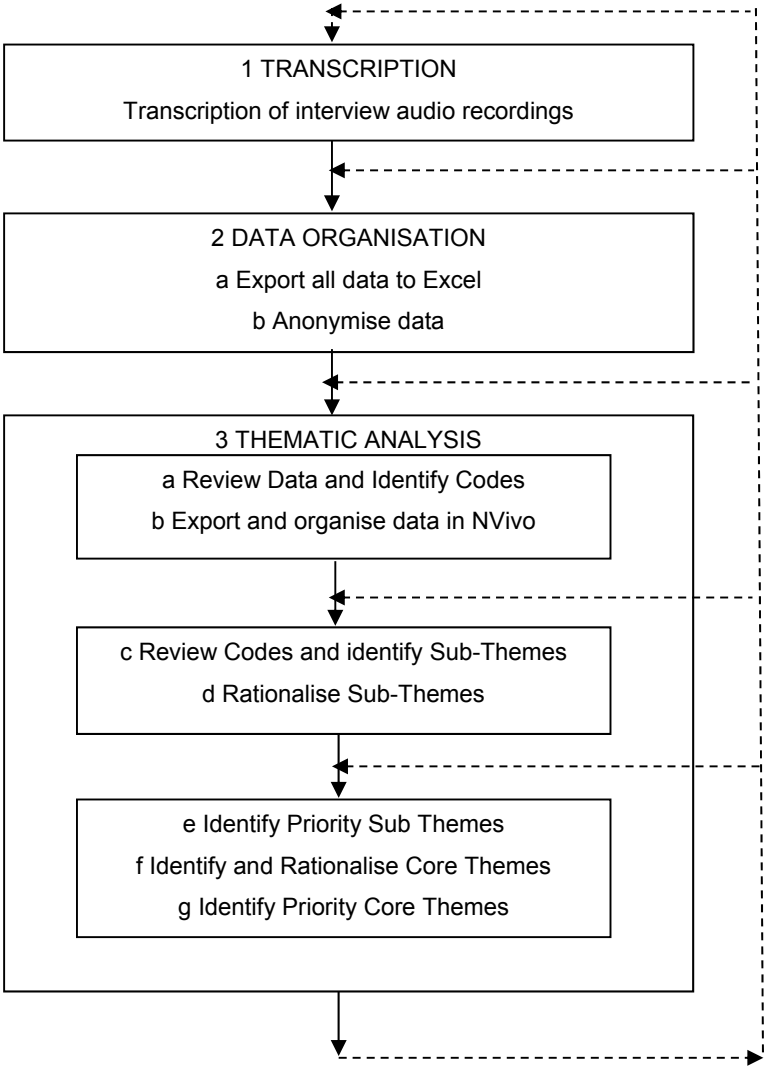


Figure 6: Data Analysis Process For Research Questions One and Two

After importing coded documents in tab delineated text format into NVivo 11, the software was used to identify sub- themes from codes and link these items to the text in the transcripts, field and observation notes.

One additional reason for using NVivo software was its ability to calculate the number of references assigned to each code and associated sub- theme. For this research, the number of references coded to a node has been used as a means of indicating the importance of each code and higher order themes (i.e. sub- themes and core themes) to which they are related. The logic being the higher the number of references indicates an increased frequency a participant

discusses a specific topic. It is however acknowledged that a participant could discuss an important topic on a lower number of occasions and this is accommodated for when reviewing themes with a lower number of references individually and determining their importance with respect to theory development.

The aforementioned data is produced by the export node summary function in Excel file format using NVivo 11. Example tables produced using data from this investigation using this function can be seen in Tables 15 and 16 in this chapter. Using the data from the aforementioned tables in Excel, priority sub-themes and core themes (i.e. a subtheme or core theme that has a high number of references) were then identified for each case in each sub-group.

3.7.1 TRANSCRIPTION

All interview audio recordings were transcribed manually thereby ensuring congruency between the transcript and the anecdotes recorded. This exercise also enabled the researcher to get closer to the qualitative data and therefore help conduct the data analysis more effectively.

3.7.2 DATA ORGANISATION

a Export all data to Excel

To facilitate quick navigation of the data, all transcripts, observation and field note documents in turn were exported into an Excel spreadsheet. Interview transcripts were formatted in a table with two additional blank columns to assign Research Question Numbers (RQ No), Codes and a column for comments. Note also that each document was divided up into Story Phases (start, middle and end), where each phase was divided equally according to the length of the interview. For Observation and Field Notes, a similar approach was adopted where each phase was divided according to the number of rows within the spreadsheet.

b Anonymise Data

All relevant participant company details and company product details were anonymised and while doing so a list of anonymised data was populated. Each person was given a pseudonym and each company and product was allocated in a name in alphabetic order (e.g. Company A and Company A Product A, etc).

3.7.3 THEMATIC ANALYSIS

The first four steps of thematic analysis as outlined by Braun and Clarke (2006) were applied to the interview, observation and field note data to review and identify codes and sub-themes (i.e. Steps a to d).

a Review Data and Identify Codes

All interview transcripts were reviewed for accuracy with the audio recordings of the interviews. In addition, supporting observation and field note documents were checked for accuracy. While reviewing each row of data, initial ideas were noted in the comments field where appropriate. At this stage it was important to keep an open mind and not draw associations with any related theory. Codes were identified from interesting elements of data and using the initial ideas where they were noted as a guide. Research question numbers to which each code related to were then assigned to assist sorting by using the filter function within Excel. Notes were made in some cases to explain the rationale for assigning it. In addition, to distinguish specific pieces of text within a transcript that had been coded to a research question number a different colour was used. Table 14 provides an example set of codes and shows how they relate to an extract of transcript data.

Response:	RQ No:	Code:	Comment:
The more people side of engineering, I suppose, with the knowledge.	RQ1	RQ1: Elaine describes her work as being involved in the people side of engineering	Emphasis of People skills is noted
An environment. So I think, you know, you grow up…I grew up thinking engineering was very…I know it's a very structured, it's a very professional industry, but I think over my what, ten years or so in that area, I've seen a change. It's more about erm how do you win the next job while you connect better with the people who you're trying to get the job from rather than telling them explicitly how things are done, or try to coerce them or force them.	RQ1; RQ1	RQ1: Elaine grew up thinking that Engineering was a very structured, very Professional Industry; RQ1: Growing importance of people skills in Engineering;	Contrasts of Engineering being made as being either ordered and unordered
It's more about the connection, and the people who were my managers, they could make a connection and I did find that very inspiring in that particular field. In terms of actually doing the knowledge management, there's been a few people such as erm Company E2 CEO, in America, who I had the chance to work with. Erm he was able to make quite technically focused people look outside of the technicalities and look more at, erm well I suppose like the emotional side of getting business, the emotional side of connecting with somebody in order, again, to get their trust so then they were receptive of the information that they were putting across.	RQ1; RQ2; RQ1	RQ1: Growing importance of people skills in Engineering; RQ2: Inspirational person Company E2, CEO; RQ1: Developing trust by getting Engineers to look beyond technical issues	Good example of how one person could get could connect with technical people in an untechnical, affective way.

Table 14 Example Transcript Text and Codes

b Export and organise data in NVivo

The table populated in Excel was then imported into the NVivo software package (NVivo version 11.41.1064 QSR International Pty Ltd, Australia). Thematic data was organised within NVivo, using the Code/Node folder structure as outlined in Figure 7, for consistency this structure was used for all case study data.

Nodes were created in NVivo by copy and pasting each code listed in the spreadsheet. A link was then created between the relevant passage of text found in each source document and the node itself.

Case Study 1 Case Nodes and Source Documents:
CS1 Interview 1 Transcript;
CS1 Observation Notes;
CS1 Field Notes

Case Study 1 (CS1) Code, Node and Folders:
CS1 Narrative Analysis_RQ1 [folder]
  CS1.1 Beginning_RQ1 [folder]
    CS1.1 Sub Theme #1 [Parent Node]
      CS1.1.1 Code #1… [Child Node]
      CS1.1.2 Code #2… [Child Node]
      CS1.1.3 Code #3… [Child Node]
  CS1.2 Middle_RQ1 [folder]
    CS1.2 Sub Theme #1 [Parent Node]
      CS1.2.1 Code #1… [Child Node]
      CS1.2.2 Code #2… [Child Node]
      CS1.2.3 Code #2… [Child Node]
  CS1.3 End_RQ1 [folder]
    CS1.3 Sub Theme #1 [Parent Node]
      CS1.3.1 Code #1… [Child Node]
      CS1.3.2 Code #2… [Child Node]
      CS1.3.3 Code #2… [Child Node]

Figure 7: Code/Node Folder Structure in NVivo for Case Study Research Questions One and Two

c Review Codes and identify Sub-Themes

In NVivo, sub-themes were identified from the codes. This involved sorting the codes into broader categories in a process of iteratively reviewing all codes for each story phase within each case. The research question itself, and associated theoretical concepts such as trust development and collaborative working were used as a means to set boundaries for this identification process. At this stage it is also acknowledged that sub-themes may be renamed, combined, broken up or even discarded (Braun and Clarke 2006).

d Rationalise Sub-Themes

Sub-themes for each case that emerged from the previous step were reviewed with the aim of identifying which ones were inappropriate due to weak association with the list of codes and data itself. As a consequence, this required reviewing the sub-theme to ensure that it was consistent and complementary with the codes and text and if required, their expression was revised. The sub-theme was also checked to see if it had resonance with all data for the case study as a whole.

Parent Nodes were created for each sub-theme and the codes were associated to each sub-theme (Parent Node) in NVivo. Sub-theme and constituent code data for Research Question One and Two and each story phase were then exported into Excel using the export node summary function in NVivo. Figure 8 shows a list of sub-themes with their allocated codes within NVivo.

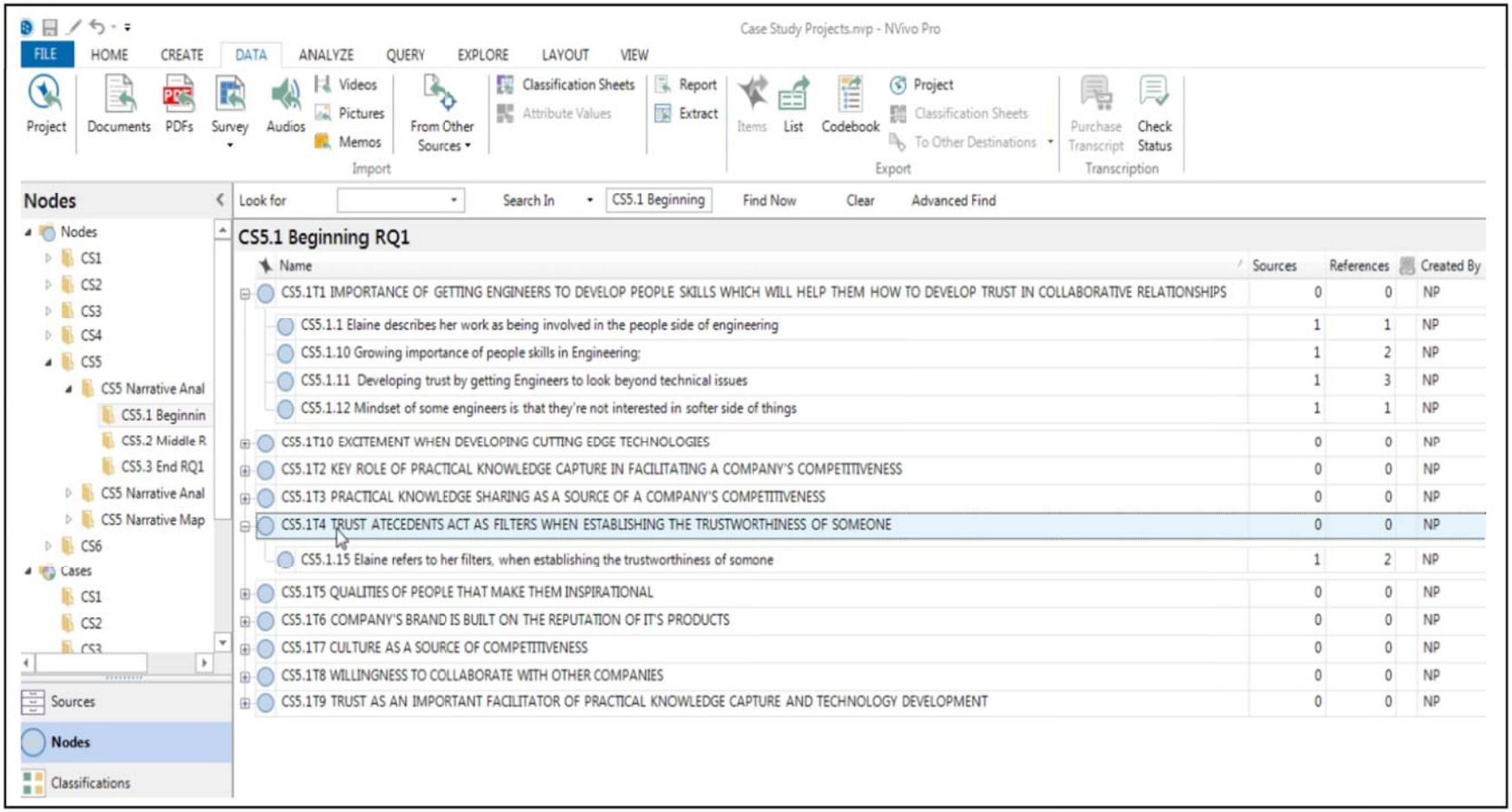


Figure 8: List of Sub-Themes and Codes in NVivo

e Identify Priority Sub Themes

Using a spreadsheet of the exported sub-theme and code data from NVivo, the number of times a piece of text appeared within the text (or reference number) were assigned to each open code from NVivo were then totalled up for each sub-theme. Priority sub-themes to be considered for analysis were identified for each story phase which had the highest number of references. Individual sub-themes were also selected with low number of references but were considered to be important by the participant and had importance from a theoretical perspective. Tables 15 and 16 show two example lists of sub-themes and associated codes with reference numbers assigned by NVivo.

Name	Sources	References
CS5.1T1 IMPORTANCE OF GETTING ENGINEERS TO DEVELOP PEOPLE SKILLS WHICH WILL HELP THEM HOW TO DEVELOP TRUST IN COLLABORATIVE RELATIONSHIPS	**4**	**7**
CS5.1.1 Elaine describes her work as being involved in the people side of engineering	1	1
CS5.1.10 Growing importance of people skills in Engineering;	1	2
CS5.1.11 Developing trust by getting Engineers to look beyond technical issues	1	3
CS5.1.12 Mindset of some engineers is that they're not interested in softer side of things	1	1
CS5.1T4 TRUST ATECEDENTS ACT AS FILTERS WHEN ESTABLISHING THE TRUSTWORTHINESS OF SOMEONE	**1**	**2**
CS5.1.15 Elaine refers to her filters, when establishing the trustworthiness of somone	1	2

Table 15: Sub-Themes and Associated Codes with Reference Numbers (Example 1)

Name	Sources	References
CS5.3T6 RELATIONAL CAPITAL AS A SOURCE OF COLLABORATIVE RELATIONSHIP DEVELOPMENT	**4**	**4**
CS5.3.2 By attending the Seminar Elaine felt respected by the Software Provider	1	1
CS5.3.21 Relational Capital is mostly intangible and difficult to measure	1	1
CS5.3.22 Relational Capital is a source of a company's competitiveness	1	1
CS5.3.4 The Software Company is more endearing to Elaine	1	1

Table 16: Sub-Themes and Associated Codes with Reference Numbers (Example 2)

f Identify and Rationalise Core Themes

Priority sub-themes were populated in a separate Excel spreadsheet and higher order sub-themes (core themes) were identified from each sub-theme and then these were rationalised to identify core themes related to all cases within each sub-group. Note that this was done in a similar manner using steps c and d for all case study sub-themes. This method of identifying themes was developed to aid the direct comparison of anecdotes (or short stories) and related to sub-themes across all cases within and between each sub-group. Table 17 shows an example list of Sub-Themes and assigned Core Themes.

Case Study No:	Sub-Themes:	Core Themes:
Story Phase	Research Question 1 (RQ1) (Ref No)	
Case Study Three:		
End:	Transparency facilitates the development of relationships (2)	Trust Development in Collaborative Relationships
	Goodwill and benevolence plays a part in developing relationships with customers (2)	Trust Development in Collaborative Relationships
Case Study Five:		
Beginning:	Importance of getting Engineers to develop People skills which willl help them how to develop trust in Collaborative relatonships (7)	Trust Development in Collaborative Relationships
	Trust antecedents act as filters when establishing the trustworthiness of someone (2)	Trust Development in Collaborative Relationships
End:	Relational capital as a source of Collaborative Relationship development (4)	Trust Development in Collaborative Relationships
Case Study Five:		
Middle:	Practical knowledge capture and learning processes that initially appear to be non-productive (5)	Capture and Sharing of Practical Knowledge is Highly Indvidualistic
End:	Variation in the focus and depth to which companies capture practical knowledge (1)	Capture and Sharing of Practical Knowledge is Highly Indvidualistic
	The success of discussion forums varies with the nature of a company's working practices (3)	Capture and Sharing of Practical Knowledge is Highly Indvidualistic

Table 17: Example Large Company Sub-Themes and Assigned Core Themes

g Identify Priority Core Themes

Priority core themes were identified by adding up the number of references from each constituent sub-theme that was calculated from NVivo. Table 18 lists the priority core themes and reference numbers for the Large company sub-group for Research Question One. Table 18 shows two core themes *"Trust development in collaborative relationships",* which was identified as priority with 17 references cited within all related priority sub-theme data and *"Capturing and sharing of*

practical knowledge is highly individualistic", which had 9 references, which was identified as a lower priority core theme.

Core Theme	Refs:
Trust development in collaborative relationships	17
Capturing and sharing of practical knowledge is highly individualistic	9

Table 18: Example Large Company Core Themes for Research Question One

3.7.4 CASE STUDY AND CROSS CASE NARRATIVE ANALYSES

Narrative analysis is the representation of a story that provides some form of explanation to a case study (Polkinghorne 1995). It is important to note that the aim is to explore the meaning of one subject's experience and not to look for patterns across a number of cases. Like all forms of qualitative analysis, the aim is not to generalise from a single case. To produce a story in narrative analysis, data is synthesised in a number parts to form a plot that looks to tie together the experiences of one or a number of individuals and create a specific set of circumstances for meaning making (Polkinghorne 1995). It is noted further that presentation of the analysis is written in the first person and usually contains extracts of transcript from a participant that in principle should transform a subject under study into a portrait (Stronach and Maclure 1997).

In the context of this research, first a narrative analysis has been conducted using the anecdotes from two case studies related to a specific core theme for Research Questions One and Two. One anecdote related to the beginning, middle and end story phases of each transcript have been selected to provide a representative sample of stories for each case. As a consequence, at the case study level, six narrative analyses have been conducted for the SME and Large company sub-groups.

The findings from the first narrative analysis were then used as a base to compare anecdotes across cases within each sub-group. It is acknowledged that this approach represents a departure from conventional narrative analysis, where one case is typically used. This approach however enabled the researcher to compare stories from different cases on the basis of specific aspects of the

participants' working practices. Note that this analysis was also conducted for Research Questions One and Two, therefore making a total of 12 anecdotes being analysed for each sub-group.

3.7.5 COMPARISON OF SME AND LARGE COMPANY SUB-GROUPS

The comparison of narrative data across SME and Large company sub-groups was conducted using analysis of narratives. This form of analysis typically looks across the entire sample of cases to identify paradigmatic categories and uncover commonalties across stories. Typical forms of analysis include the analysis of narrative from a linguistics perspective stories in terms of textual function and structural form by Labov and Waletzsky (1997) and analysis of narrative in terms of form and content by Lieblich Tuval-Mashiach and Zilber (1998). Polkinghorne (1995) has also noted the strength of this type of analysis in its ability to formulate more abstract concepts from specific stories.

This part of the research compared the findings from the narrative analysis at the cross case level for each sub-group using analysis of narratives. This focussed on comparing specific aspects of each anecdote for Research Question One and Two and comparing and contrasting the findings with the literature. It is acknowledged that this approach represents a departure from conventional analysis of narratives, where for example some form of paradigmatic or structural analysis is typically used (Lieblich Tuval-Mashiach and Zilber 1998). By using such an approach it was however possible to compare the findings of the narrative analysis on the basis of specific aspects of the participants' anecdotes.

This analysis will consider the narrative data produced from each sub-group and therefore will analyse key elements of twenty four anecdotes from both the SME and Large company sub-groups.

3.8 DATA ANALYSIS FOR RESEARCH QUESTION THREE

In this investigation a method was developed by the researcher to capture specific instances of trust based practical knowledge sharing, based on flow charting (Gilbreth and Gilbreth 1921) and utilises the integrative trust model by Mayer, Davis and Schoorman (1995) and practical knowledge taxonomy as

formulated by Guzman (2009). This novel method has been used to map discrete elements of anecdotes related to the four areas of supplier/partner identification and selection, contract negotiation and development, work based learning (informal learning) and collective reflection. This analysis therefore compared the trust and knowledge sharing characteristics from eleven narrative maps in total.

Map data has been analysed using the analysis of narratives method for one case sample from each sub-group. This analysis focussed specifically on comparing specific aspects of each anecdote for Research Question Three and compared and contrasted the findings with the literature.

3.8.1 NARRATIVE MAPPING MODEL AND PROCESS

Narrative maps were developed by the researcher to map discrete elements of trust based sharing of practical knowledge as identified within anecdotes from the interview transcripts and in a smaller number of instances from observation notes.

The mapping model for narrative maps is based on the integrative model of trust as originally proposed by Mayer, Davis and Schoorman (1995) shown in Figure 9.

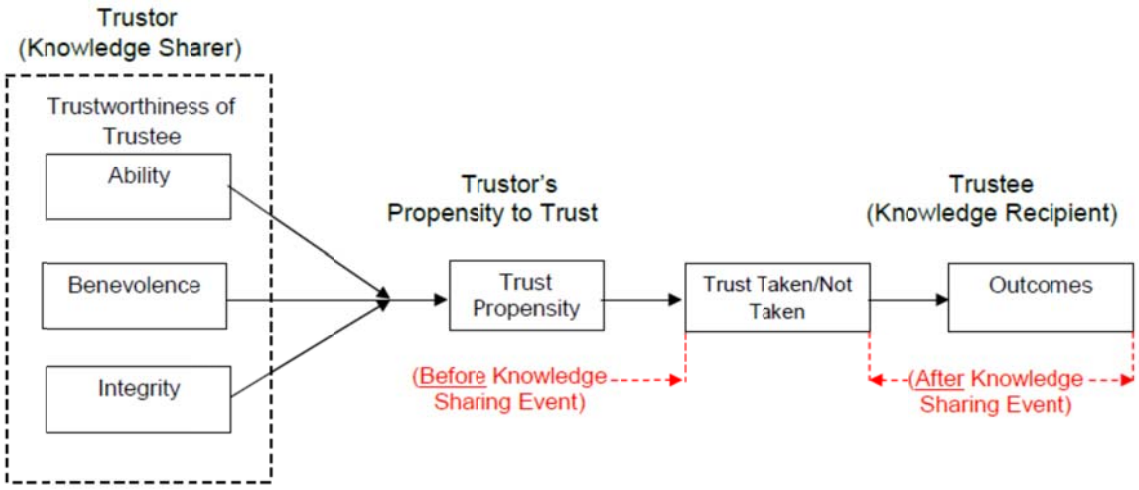


Figure 9: Trust based Knowledge Sharing Model

Trust based knowledge sharing in this research is based on the premise of a trustor and trustee, where the trustor is the person who is sharing some piece of knowledge. Justification for assigning the person as sharing the knowledge as being the trustor, is based on the notion that this person is making themselves vulnerable to the other person who is in receipt of the knowledge. In this case, it is anticipated that the level of vulnerability may be proportionate to the perceived value of the body of knowledge being shared.

The trustor may utilise trust antecedents to ascertain the level of trustworthiness of the trustee and then make a decision to share the knowledge with the trustee (trust propensity). The decision to trust, or trust propensity has not been included in each narrative map as the decision to trust in every case was taken.

Upon making a decision to share knowledge, this may then result in some form of outcome(s) being produced that may benefit the project upon which both partners are working.

To develop the trust knowledge sharing model further to accommodate the sharing of practical knowledge, trust behaviours and actions were selected as appropriate items to be mapped, that would in turn provide some indication as to what trust antecedents are utilised by the trustor. It is important to note here that mapping has been undertaken from a behavioural perspective and given that trust also has cognitive and affective (emotional) components (Lewis and Weigert 1985), this would therefore imply that these two trust components are being estimated based on the behaviour of the participant. While it is acknowledged that some level of judgement is required to do this, there is scientific support from for example Armitage and Conner (1999) in a theory of planned behaviour, where the authors found some causal links between beliefs, attitudes, intentions and behaviours of their study sample.

To consider the development of trust based knowledge sharing models to accommodate the sharing of practical knowledge, the taxonomy of practical knowledge as proposed by Guzman (2009) has been considered where its four forms of practical knowledge are defined with examples of how each applies in

practice. It should be noted that the two definitions for tacit procedural knowledge and tacit practice have been adapted to consider practical knowledge as having levels of tacitness, where tacit knowledge could be imperfectly articulated or personal. This position has been adopted to make the collation of tacit practical knowledge marginally easier for the purposes of this research. In Guzman's (2009) taxonomy, the author outlines that tacit knowledge cannot be shared explicitly.

- Explicit Procedural Knowledge:
  This knowledge about how to do a practical action, which although not clear may still be verbalised or explained through drawings (Guzman 2009). Other terms that can be used to describe this form of knowledge are encoded knowledge (Blackler 1995) and know how (Ryle 1962). This type of knowledge may be a procedure required to fix a specific photocopier problem. For example: "*when a photocopier exhibits a specific type of symptom(s), then a number of parts need to be checked to see if they are fitted correctly".*
- Explicit Practice:
  This form of knowledge is established by logical rules and is goal orientated (Spender 2005). Explicit practice in the main is delivered through codified and mechanised actions that apply reason dominated explicit procedural knowledge (Guzman 2009). This type of knowledge may be explicit actions about a specific machining operation that can be described. For example: "*A machine was used, the cutter did not perform well when I was machining a particular feature, which resulted in the overall machining time taking 5 minutes longer than that estimated".*
- Tacit Procedural Knowledge:
  Adopting Ambrosini and Bowman's (2001) levels of tacitness, this form of knowledge is defined as concepts and ideas and experiences related to actions that could be articulated or imperfectly articulated. This type of knowledge may be settings on machine(s) which can be generalised but are still quite difficult to explain. For example *"When assembling a photocopier*

the screws are usually tightened up finger tight and a pin is 'wiggled' until the clearance between two parts of the machine is approximately 15millimetres".

- Tacit Practice:

  This is the application of tacit knowledge based on previous experience executed consciously or unconsciously to perform a specific action that could be articulated or imperfectly articulated (Ambrosini and Bowman 2001, Guzman 2009). Tacit practice may be a specific experience when diagnosing the problems with a machine. For example, "*when diagnosing a machine, the engineer observed the pattern of noises it produced which provided an indication as to what was happening".*

It should be noted that procedural knowledge is generally regarded within the knowledge management literature as being tacit in nature and related to action (doing), and declarative knowledge is regarded as being explicit in nature and related to facts, tasks and methods (describing) (Nickols 2000). As a consequence, explicit procedural knowledge as defined in this research is similar to declarative knowledge as described by Nickols (2000).

In this research, knowledge sharing is considered as a cycle that can be initiated by one person (e.g. an SME) or the other partner (e.g. large company) accompanied by similar sequence of activities by the other partner. In the second half of the sharing cycle, the trust antecedent is renamed as a 'trust descendent'. This concept has been created to reflect how the behaviours and actions of the trustee would be 'signalled' or perceived by the trustor. The notion of trust descendants as formulated here are broadly consistent with the concept of Signalling theory as originally proposed by Lindberg (Kramer and Lewicki 2010), where relational signals are used to construct trust-based behaviours. For the purposes of this research, trust descendents have been classified in the same way as trust antecedents.

Obviously in practice, this cycle of knowledge sharing takes place continuously between collaborating partners, however for the purposes of this research, the aim was to map one or a number of knowledge sharing cycles based on the data that was available. As a consequence, the knowledge sharing cycles mapped for each relationship phase for each case are not consistent, but are considered to

be an accurate representation of the participant's anecdotes. Figure 10 shows the structure of a generic Narrative Map.

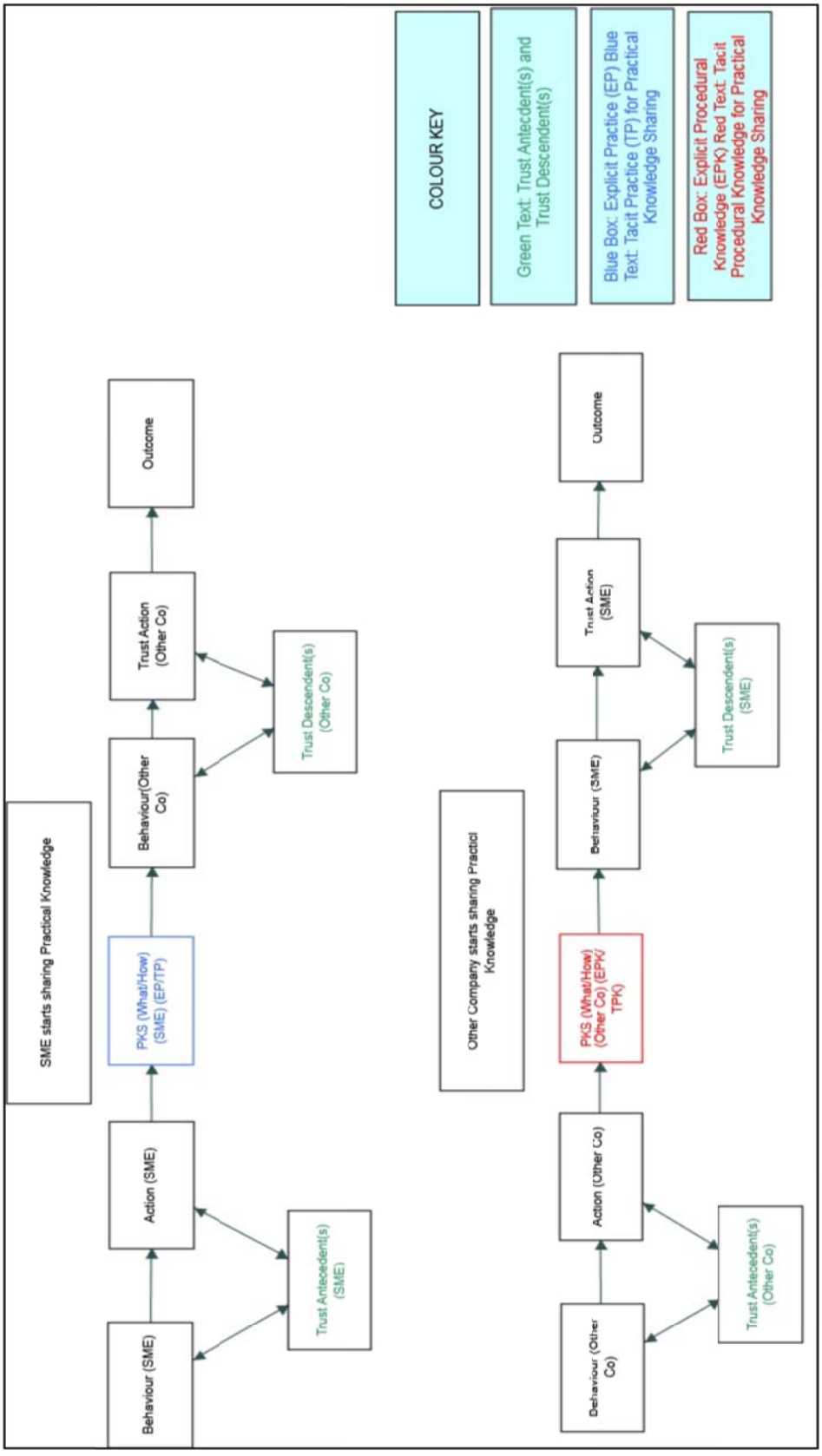


Figure 10: Generic Narrative Map

The steps that were executed to develop a Narrative Map are listed as follows:

1 The transcripts, observation notes and field notes formatted in Excel to produce the initial codes for the thematic analysis were put into a new spreadsheet and columns were added according to the items shown in the generic narrative map. Note that a separate column termed 'Map Filter' was added to sort data related to each map.

2 The data was reviewed to identify those pieces of text that related to Research Question Three. This step was therefore similar to coding in thematic analysis where specific pieces of text are assigned to a code. In this step, however the text was assigned to a specific story/anecdote Reference number as shown in Table 19.

Relationship Phase:	Relationship Phase Ref No:	Story/Anecdote Ref No:
Relationship Formation	RQ3A	RQ3A1
		RQ3A2
Relationship Implementation	RQ3B	RQ3B1
		RQ3B2

Table 19: Example Story/Anecdote Reference Number Assignment

It is acknowledged that a specific number of questions focussed specifically on the four areas of relationship development, however it was thought that there may be other areas of the transcript that could also be used for this exercise. At this point the researcher was mindful to note which partner started the knowledge sharing cycle, either the SME, or the large company and number sharing cycles that could be mapped in an accurate and complete manner.

3 After adding the story/anecdote reference number, each piece of text was read and portions of it were assigned to relevant cells that intersected with the behaviours, actions, trust antecedents/descendants, and practical knowledge shared columns for each partner as follows:

a Behaviours and actions were extracted from the narrative.

A behaviour and action is distinguished based on the following definitions.

Behaviour is defined as *"a range of actions and mannerisms made by organisms, systems, or artificial entities in conjunction with their environment, which includes the other systems or organisms around as well as the physical environment"* (Campbell 1981). Action is defined as *"an activity with intentions, which requires awareness of the actor"* (Campbell 1981).

b Trust antecedents/descendants were identified from the behaviour and action. This was facilitated by using a list of trust antecedents reported in the literature (e.g. see Seppänen, Blomqvist and Sundqvist 2007) which can be found in Appendix E.

c Evidence of the practical knowledge shared was listed in the relevant cell and the cell border or text was colour coded in a similar manner to that shown in the generic narrative map according to the type of practical knowledge that was being shared.

4 The text data was then reviewed for evidence of any outcomes being produced and this was placed in the last intersecting cell with the Outcome column.

5 If a narrative map was composed of more than one knowledge sharing cycles, then the data was assigned based on the number of cycles that could be mapped accurately and completely. For reference purposes, each cycle had been numbered at the trust antecedent stage, to act as a point of reference when referring to specific items on the map. Example narrative maps that present trust based knowledge sharing activities related to a number of short stories or anecdotes can be found in Appendix F.

3.9 LIMITATIONS OF RESEARCH DESIGN

While great amount of attention has been made in ensuring that the research produced trustworthy outcomes, some of the main limitations of the research design are outlined.

Specific aspects of trust are considered in a bid to simplify what in reality is a very complex process. One major limitation therefore, is the project's ability to

accurately reflect how trust is enacted in reality. For example, trust may be enacted on the basis of gut feeling (Pinto, Slevin and English 2009) where criteria for such trust antecedents (Mayer, Davis and Schoorman (1995) are considered. This limitation resulted in numerous challenges that impacted on the researcher's ability to produce a research design that could be deemed effective. This was particularly evident when developing the interview guide.

This research looked to understand how trust influenced the way engineering practitioners share practical knowledge within different contexts. While the aim was not to produce a research outcome that could be generalised, the anecdotes captured do however provide a detailed picture of how trust based working practices change over the life of a project.

While conducting interviews, it is acknowledged that for example the terminology used or phrasing of questions may have inhibited some participant's ability to provide accurate stories. For example, most stories provided by participants related to collaborative working with other partners either in the same company, or another company. This immediately presented a challenge in that the researcher captured the view of one person. It therefore could be argued that the stories captured represent half the story as the other partner may have had a very different view. Qualitative researchers invariably get round this problem by interviewing people in dyads or groups (e.g. Ambrosini and Bowman 2001). Stories however can be told from many perspectives and therefore it is argued that the anecdotes are factually accurate from the perspective of the participant.

3.10 QUALITATIVE DATA VALIDITY AND RELIABILITY

The principles of validity and reliability are widely known in quantitative research (Neuman 2006), the basic principles are used differently in qualitative research as they have different connotations. For example qualitative researchers consider validity from the perspective of confidence rather than certainty, which is used by positivists (Angen 2000). As a consequence, internal and external validity and reliability are known by qualitative researchers as credibility, transferability and dependability and collectively refer to this as the 'trustworthiness' of qualitative data (Shenton 2004).

In the context of this research, the credibility (internal validity), transferability (external validity) and dependability was enhanced by employing the following strategies.

- The credibility of the research was insured by using a number of primary sources of data and data collection methods thereby enabling the research to capture rich data. In this research semi structured interviews, participant observations supported by field notes helped the researcher to build a genuine and credible picture of collaborative working from the perspective of the participants.
- The primary sources of data in all cases were also supported by secondary sources of data where notes were taken about the key characteristics of each company from their websites, which were mentioned in each of the participants' anecdotes.
- By using a screening questionnaire participants were chosen using specific selection criteria on the basis of the quality of their experience thereby ensuring that credible data was gathered.
- When conducting semi structured interviews, proactive measures were taken to ensure that the data produced enabled the researcher to answer the research questions in an effective manner. For example, before each interview, a copy of the participant information sheet, which provides an outline of the project was emailed to participants. In addition to this, at the start of the actual interview, the researcher provided an overview of the project and gave an explanation of any key terms used by the research (e.g. trust and the sharing of practical knowledge).
- At the end of each interview, the researcher asked the participant if they had any questions or comments to make. This therefore provided the participant with the opportunity to further comment on or clarify any of the issues discussed in the meeting therefore ensuring the credibility of the interview data.

It is not the objective of this research investigation to produce research outcomes that can be transferred or generalised (Yin 1994), however it is anticipated that the work within this thesis would provide other researchers with the ability to

compare other research initiatives. Transferability was however enhanced by conducting case study research with six participants in a broad range of engineering sectors where patterns in thematic data were identified within and across each case, further enhancing the credibility and dependability of the research outcomes.

Dependability in qualitative research ensures that the data collection procedures can be repeated and produce the same results (Yin 1994). In this research, the same interview process was applied to six case studies where the same questions were used with the aim of enhancing the dependability of the research.

Another feature used throughout the data collection and analysis is reflexivity. Most notably, this was used when interviewing participants, making observation notes and formulating the narrative analysis. There is some debate generally within the literature as to what it means to practice reflexivity when conducting ethnographic type research. When conducting interviews for example, Fine, (1994) comments that interviewers should develop an awareness of the complex interplay between themselves (self) and participants (other) to understand their experiences. Gouldner (1970) on the other hand proposes a more radical sociological approach where the researcher takes a more active role within their participant's environment.

The form of reflexivity used in this research is in line with that proposed by Fine, (1994) and it is noted by Krefting, (1991) that reflexivity helps to increase the trustworthiness of the research by adopting credibility and confirmability strategies.

3.11 ETHICS AND CONSENT

The following protocols and procedures were followed by the researcher to ensure that data was collected in an ethical manner. It should be noted that all protocols and procedures followed are compliant with Northumbria University's Ethical Policies as outlined in the University's Research, Ethics and Governance Handbook.

- Ethical approval was granted for this project within the first year of the project on the 20/10/2015. To achieve approval the relevant research ethics documentation was completed and submitted through the University's on-line Ethical Approval System.
- All participants' names, organisations and products were anonymised within the interview, observation and field note documentation to reduce concerns that the answers could be interpreted particularly in the case of divulging sensitive information.
- Before conducting each interview, participants were told that they were free to decline any of the interview questions if they chose and free to leave at any time.
- Participants were also asked if they were happy for the researcher to record the interview.
- All participants were given a participant information sheet, which provided background information about the project and details of the ethical approval.
- All participants completed a participant consent form before starting the interview. When an interview was conducted by phone, the consent form was sent to the participant before the interview took place and they signed and returned a scanned copy of it back to the researcher.

3.12 SUMMARY

Chapter Three has outlined the research philosophy, research paradigm and the qualitative methodology used. In particular, it has been noted that this research has utilised a number of methods to collect and analyse the research data thereby enabling the researcher to build a genuine and credible picture of collaborative working from the perspective of the participants.

Notable limitations of the research design have been then considered along with details of how ethical and consensual issues have been addressed by the research.

CHAPTER FOUR
SME SUB-GROUP NARRATIVE ANALYSIS

4.1 INTRODUCTION

Chapter Four presents the findings of the thematic analysis and a narrative analysis for two priority core themes that have been identified within the textual data for Research Question One (RQ1) and Research Question Two (RQ2). This analysis also uses data from three sample case studies from the SME sub-group. A cross case narrative analysis is then presented where the findings from the narrative analysis are compared along with additional supporting data for Research Question One and Two.

For reference purposes, Research Questions One and Two are listed as follows.

1 What are the main characteristics of a trust based practical knowledge sharing culture within the sample of SMEs and large companies?

2 What are the specific perceptions and experiences of engineering practitioners who adopt trust based strategies for sharing practical knowledge for each collaboration relationship phase within the sample of SMEs and large companies?

For research question two, the study also investigated how trust influenced the development of collaborative relationships, which have been considered as a four-phase process with a number of activities that hold implications for trust and knowledge sharing as listed below:

- Relationship formation:
  Partner identification, selection and initial trust building
- Relationship implementation:
  Contract negotiation and development
- Relationship evolution:
  Informal learning
- Relationship conclusion:
  Collection reflection

4.2 FINDINGS

Tables 20 and 21 present a list of priority core themes and associated references for Research Question One and Research Question Two for the SME sub-group investigated in this research.

It should be noted that those core themes that had sub-themes with 10 references and above, have been considered worthy of being used in the analysis. It is however acknowledged that those themes with 9 references and below may also hold some importance and therefore have also been considered when comparing the findings from each sub-group as part of the analysis of narratives in Chapter Six.

From the Priority Core themes listed in Tables 20 and 21, "*Trust Development In Collaborative Relationships*" with 35 references and "*Informal Learning*" with 94 references had been chosen to provide a framework from which to conduct the case and cross case narrative analysis for Research Questions One and Two. These themes were chosen as it was noted that the same priority core themes existed for the Large company sub-group thereby enabling the researcher to compare narrative data.

The core theme for Research Question One *"impact of the environment on the development of trust and collaborative relationships"* with 38 references was not chosen at this stage as the sub-themes and associated anecdotes were located within one case study (i.e. Case Study One). It therefore was decided to choose the next core theme *"trust development in collaborative relationships",* with 35 references which had a more even spread of sub-themes and associated anecdotes. It should however be noted that the first core theme was used later in the analysis.

Tables 22 and 23 list the priority core themes and associated sub-themes for Case Studies One, Two and Six within the SME Sub-group that were used in the analysis. It should be noted that one sub-theme relates to one anecdote and therefore, within this analysis it can be seen that 6 anecdotes were chosen for each research question.

Core Theme	Refs:
Impact of environment on the development of trust and collaborative relationships	38
Trust development in collaborative relationships	**35**
Collaborative relationship behaviours	25
Informal learning	23
Impact of culture on working environment	15
Informal Social network development	14
Inspirational people, mentors, entities and their qualities	12
Practical knowledge sharing mechanisms	11

Table 20 SME Sub-Group Priority Core Themes and References for Research Question One

Core Theme:	Refs:
Informal Learning	**94**
Work experience undertaken	89
Operational systems and processes	31
Collaborative relationship behaviours	27
Trust development in collaborative relationships	26
Practical approach to achieving outcomes	15
Collaboration approach	13
Practical knowledge sharing mechanisms	12
Range of company products and services	12
Practical knowledge sharing behaviours	12
Development of a Monitored Professional Development Scheme	11
University college education	10
Utilisation of rapid prototyping technology	10
Notable collaborations	10

Table 21 SME Sub-Group Priority Core Themes and References for Research Question Two

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 1 (RQ1)	
Case Study Two:		
Beginning:	Trust Development in Collaborative Relationships	Older Company Staff treat younegr staff like a family member (11)
		Readiness to show Visitors around the factory (1)
Case Study Six:		
Beginning:	Trust Development in Collaborative Relationships	Using Suppliers who are Known and Easy to Work With (9)
Middle:	Trust Development in Collaborative Relationships	Being tolerant with other work colleagues (7)
		Honesty and faith with Internal and External partners (3)
End:	Trust Development in Collaborative Relationships	Daily work is conducted in a manner that builds trust (2)

Table 22 SME Sub-Group Priority Core Themes and Sub-Themes Chosen for Analysis for Research Question One

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 2 (RQ2)	
Case Study One:		
Beginning	Informal Learning	Learning products, processes and software on the job (11)
Middle:	Informal Learning	Seeking advice on issues related to Engineering practice (4)
End:		Learning products, processes and software on the job (4)
Case Study Six:		
Beginning:	Informal Learning	Learning with and from others through shared understanding and practice (17)
Middle:	Informal Learning	Learning by applying Production Planning Systems and associated processes (24)
End:	Informal Learning	Learning from others through shared understanding and practice (13)

Table 23 SME Sub-Group Priority Core Themes and Sub-Themes Chosen for Analysis for Research Question Two

All of the thematic data presented in Tables 20 to 23 can be traced back to the raw transcript data through the sub-theme and constituent code data tables that were exported from NVivo, for example see Tables 15 and 16 in Chapter Three.

4.3 SINGLE CASE NARRATIVE ANALYSIS

This sub-section presents a narrative analysis for Research Questions One and Two using data identified from the core themes of *"Trust Development in Collaborative Relationships"* and *"Informal Learning".* This analysis is done using data from Case Studies One, Two and Six.

4.3.1 RESEARCH QUESTION ONE (RQ1)

In this sub-section the anecdotes of Brian from Case Study Two and Frank from Case Study Six are presented, which both relate to the core theme of *"Trust Development in Collaborative Relationships".*

4.3.1.1 CORE THEME: TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

1 ANECDOTES OF BRIAN (CASE STUDY TWO)

Case Study Two is concerned with the anecdotes of Brian a Design Engineer who works for an SME (Company O), which designs and manufactures special purchase machines. The anecdotes of Brian relate to his early days working as a trainee at Company I and some observations that were made by the researcher after interviewing Brian at Company O. The aforementioned anecdotes have been obtained by semi-structured interview, which were conducted at Company O and by making field notes.

Anecdote One:

Brian recalls his time working as a young engineer working at Company I, which is also an SME. He specifically remembers the drawing office staff who were mainly in their 50s and 60s and looked upon him with "parental vision". I observed instantly from this that the drawing office staff appeared to treat Brian like a member of their family. This paternal family-like culture appeared to be

evidenced when Brian remembered the first time he made a mistake when designing a piece of equipment. Brian takes up the story:

Extract One:

Yeah, aye. Certainly in the drawing office it was a nice tight group, we worked nicely as a team. Everybody was looked after. I can remember the first time I designed something and I made a mistake and I went back up to the drawing office and I've hit my hands, oh I've done it wrong, I'm going to get the sack here.

Upon learning that Brian made a mistake, the older members asked Brian what he had done wrong and asked to have a look at it. They then openly admitted to making big mistakes and then proceeded to tell Brian about some of the mistakes that they had made in the past. This made Brian feel much better about the situation as he explains:

Extract Two:

…and I felt much better about it because I wasn't on my own making one mistake and everything was my fault. Everybody had done stuff like that. And it wasn't a big mistake, to be honest.

Given the way Brian looked up to the older members within the drawing office, their empathic behaviour towards him was demonstrated in an open manner in admitting that they made mistakes thereby making him feel better about himself and his work. It is it is however noted that in this instance, the other members' knowledge sharing behaviours were initiated as a result of Brian's open and honest admission of making a mistake in the first instance.

Anecdote Two:

Indications of an open and embracing culture was witnessed at Company O before interviewing Brian where I noticed example prototype products were proudly put on display in the company's foyer for visitors to look at. I had a look round the products and I immediately noticed the vast range of products that the company had developed.

After the interview, Brian took me for a brief tour round the assembly area. I didn't have any safety boots, so I was given some slip on safety toe caps. It was

at this point I noted the second indication of this open and embracing culture, when I observed that the company quite thoughtfully placed a box of safety toe caps beside the main entrance to the company's production area. To me, this symbolised the company's readiness to show visitors around the plant. These safety toe caps were quite useful in that they can be slipped on over existing foot wear. It was quite funny wearing these as they felt like flippers as I walked around.

2 ANECDOTES OF FRANK (CASE STUDY SIX)

Case Study Six is concerned with the anecdotes of Frank who is a Sales Engineer at an SME, Company G2 where he has a dual role of being involved in Sales and Engineering. The anecdotes of Frank relate to his experiences working at Company G2 and Company H2 where he worked previously. The aforementioned anecdotes have been obtained by semi-structured interview, which were conducted at Company G2 and by making field notes.

Anecdote One:

When selecting suppliers at company G2, Frank comments that they generally use companies who they already know. I challenged this notion and ask Frank what the company would do if the customer required an unusual piece of equipment that they hadn't built before which may require the company to consider other new suppliers. In response to this Frank indicated that if the customer specified something exotic in a build, they would probably go back to them and seek advice as their requirement may indicate that they have experience in a specific area of engineering.

As Company G2 generally works with companies it already knows, this indicated to me that the company has worked hard at developing relationships with a broad range of partners, which in turn demonstrates that it values the relationships it has with its partners.

Frank recalls one supply company with whom Company G2 has been working for a long time and he describes his experience of negotiating contracts with them. Frank takes up the story:

Extract One:

Erm and…I mean, to be honest, it was the negotiation part of it was extremely easy. They've been dealing with us for a long time.

Frank continues:

Extract Two:

Yeah. Yeah. Erm we've supplied quite a lot of conveyor systems to them over probably going back 25 years.

Frank acknowledges that he's only been at Company G2 a couple of years and therefore the partnership with the supplier company he refers to is well before his time. He was however keen to point out that the supplier company speak very highly of Company G2 and the equipment that they have put in for them.

Whilst talking about the supplier, I ask Frank to further recall more detail about his experience in negotiating with the company. Frank takes up the story:

Extract Three:

Yeah. So really when we go in there they're pretty much saying we want to give you the work. You know, you need to do…put the contracts together you need to price it all up and this that and the other, but a lot of what it comes down to is more…well, it's not all…it's not particularly on price, you know. Obviously they've got a number that they're looking for and they don't want it to be way above that figure, but erm it's more the fact that we can support them with what they're doing and in the timeframes.

The negotiating experience appears on the face of things quite an effortless process, where the focus appears to change from that of price to one where support can be provided over a given time frame. It is also noted that this process is an outcome of many years of developing trust based relationships on behalf of Company G staff with its partners.

Anecdote Two:

Frank's second anecdote demonstrates a two-way form of tolerance which appears to exist between him and other colleagues that is highlighted when sharing design model data.

Frank's primary role involves working on projects with Company L2 and this requires using bespoke CAD software that Company L2 developed. As a consequence, when co-designing equipment with other colleagues within Company G2, Frank invariably comes up against compatibility challenges. Frank takes up the story:

Extract One:

I'm primarily just doing the Company L2 part of what we do, but if we're building say a big production line, erm Company G2 General Manager would probably be doing a lot of the design on that, and he does it all on SolidWorks, or that kind of thing anyway. And then a lot of the times he'll pass the drawings to me and I'll then have to translate his drawings onto the Company L2 software and draw them up on there, because it's a lot easier for doing the costings because you can get the cost straight out of that, you see.

I see this process as being a bit of a pain, however Frank appears to take it in his stride as he is mindful that other people also have specific requirements. For example, he notes specifically that Company G2 general manager uses Solidworks to get the sizes right and allocate part numbers. If Franks shares one of his files with Company G2 General Manager, he can use it ok in his model. Frank notes however that if Company G2 General Manager passes a step file to him, it appears as a "lump" on his screen.

Through time however, Frank has found a way of adding value to the knowledge sharing process by using a step file as a template. He takes up the story:

Extract Two:

What you can actually do, which is quite good sometimes, is you can take the STEP-file, you can draw it up and then put one over the top of the other and make sure that they are actually the same.

Given the compatibility issues such as those faced by Frank, this anecdote illustrates the value that Company G2 places on the relationships it has with its partners and in particular Company L2, who Frank primarily works with.

Anecdote Three:
While reviewing the website of company G2, two items were observed that appeared to demonstrate faith and honesty with its partners.

First of all flagship product of Company G2, Product A was first developed by Company G2 approximately 10 years ago and utilises a number of advanced technologies. Within one of the source documents identified it was rumoured that Product A may have been produced in its joint venture company in India. Presumably, this may have been to reduce labour costs, however the decision was made to design and build the product at Company G2 in the UK, indicating that senior management had faith in the company's workforce to produce quality products.

Secondly, unlike other company websites, there is a note on Company G2 website specifically outlining that the company "will not undertake work unless it is 100% confident it can do the work". It is observed here that some engineering companies may well take work on for which they are not fully capable and therefore, potential customers may be heartened to read this knowing that they will not get messed around.

Anecdote Four:
In a similar manner to that for Company G2, the website of Company H2 was also reviewed and it was noted that the group to which the company is attached to has "Ethics and Integrity behaviour" outlined as a separate company value which would appear to demonstrate the importance of these behaviours to Company H2. This value is outlined as a key mechanism to promote operational excellence and social awareness, which would indicate that Company H2 and its group members are mindful of the way they engage with their customers and how they act on behalf of themselves and their employees to the benefit of wider

society. As behaviours that consider ethics and integrity build trust, it can therefore be deducted from this that Company H2's values aim to build trust within its operations and with its customer base.

4.3.2 RESEARCH QUESTION TWO (RQ2)

In this sub-section the anecdotes of Alan from Case Study One and Frank from Case Study Six are presented, which both relate to the core theme of *"Informal Learning".*

4.3.2.1 CORE THEME: INFORMAL LEARNING

1 ANECDOTES OF ALAN (CASE STUDY ONE):

Alan is a contract Jig and Tool Design Engineer who has worked for himself for approximately five years and his company shall be referred to as Company E. Previously, Alan has worked for a Jig and Tool Design Consultancy locally, near to where he is based and it is for this company that he built up working relationships with a number of companies. Whilst working for the consultancy, over a period of approximately 4 years Alan has worked with a large (tier 2 level) automotive supplier company referred to as Company A. After setting up his own company in 2012, Alan mostly worked with Company A designing jigs, whilst being based onsite.

Two semi-structured interviews by phone and participant observations were conducted over a three working week period for Case Study One, where the experiences are primarily based on projects where Alan (Company E) has worked with Company A. In addition, observation notes and field notes were taken to further support the data collected.

Anecdote One:

As Alan is primarily based at Company A he has had to learn the working practices of Company A such as design control and how to draw parts in a particular format. Alan mentions that Company A has its own design control software that ensures that drawings are version controlled in an appropriate manner. Alan takes up the story:

Extract One:

…and really it's being taught how to use…how they lie the sheet out, the drawing sheets, what they want on the drawing sheets, what they expect, how parts lists are erm not necessarily created but how they are numbered up. Every business has its own particular way of doing things and Company A have got theirs.

In the early days, as Alan's knowledge of Company A's products and product assemblies was limited, this required him to do his work piece by piece and occasionally asking questions on how parts are referenced so he could produce detailed drawings. While learning, Company A's design working practices in parallel, he also learned how reference points and datums are used which required knowledge of Company A's product assemblies. He tells me that through time he's noticed that they are used in different ways depending on the way they fit to a larger product assembly.

As time has gone by and Alan's knowledge of design work practices and product assemblies has developed, he's learnt to ask company staff questions in a manner that would enable him to work more effectively. Alan explains:

Extract Two:

As time goes on it's like well don't just ask what the tolerance is, ask what the tolerance is from and where's the datum, what do you want to use as the datum because it might not necessarily be what's shown on the drawing. The drawing might show the datum over here, but realistically you can't use that so it has to be here.

Alan further explains his point by referring to the design of a point-set jig would be used to hold a pipe assembly. It is noted here that the geometry of such a product makes it difficult to determine how it should be orientated and located whilst being assembled to other mating product assemblies.

This anecdote demonstrates that Alan has multiple challenges; in trying to learn both Company A's working practices while also learning how their products fit together. From this anecdote and associated observations it would appear that both types of knowledge are invariably built up by Alan 'piece by piece', which

has required him on occasion to work blind, or within certain parameters with varying degrees of uncertainty.

Anecdote Two:
While conducting observations at Company A it was noted that Company A engineering staff occasionally sought advice on using Adobe Inventor. Over the time Alan has been working for Company A he has developed a reputation for his knowledge of CAD systems and has been nicknamed by some staff as the “CAD Master”.

On day two, of my observations, one member of engineering staff asked Alan specific procedures to be observed when using Autodesk Inventor. One specific issue that was encountered was where a jig was being designed which had a lot of features. One question was posed on how to build up the assembly and constraining such features by creating a reference point relative to the datum of the jig, or using XYZ plane references.

Another example demonstrates how Alan’s knowledge of Company A’s product assemblies has developed whilst designing jigs and fixtures for Company A.

Whilst observing Alan, Company A Production Engineer2 queries how an existing jig can be disassembled so it can be modified. The jig is being modified to produce an updated product model. It is also noted that the jig is calibrated using a setting up jig, which will also need to be modified to suit the other jig. Alan comments that this jig is being modified so it can assemble Car model A Heater and Blowing Unit. The jig currently assembles the Car model B Heater and Blowing Unit. It is noted that this is an important jig as it assembles most parts and if possible needs to be modified, whilst on site at Company A. Alan tells me that the modifications are not substantial and therefore doing the modifications onsite will not disrupt production.

Given that Alan is frequently approached by Company A’s engineering staff, these two examples demonstrate that they value Alan’s knowledge of CAD systems and equipment design. Through a perpetual process of understanding

the cause and effect relationships between product knowledge and Company A's working practices this has enabled Alan to design and develop a vast range of pieces of equipment for Company A. Alan's knowledge of Company A's equipment has also developed to a point where this appears to be also valued by the engineering staff of Company A.

Anecdote Three:

While interviewing Alan, he talks about his early days working for himself, where he would move frequently between companies. While working with different companies, Alan tells me that he has had experience of working with good ones and bad ones. He comments further that as soon as he goes to a place he could instinctively tell what his experience was going to be like.

Quite often he would find the challenge of learning about his client quite stressful. Alan takes up the story:

Extract One:

I've had it where I've just been dropped in, literally like I could have just parachuted out of the sky and dropped into a place and I'm there and I'm having to work on site the other side of the country and I'm stuck there for two weeks, and you've got nowhere to go and you're having to learn straight. It's learning people's names, learning where things are, learning how things are done. I mean, I had to go into a place and I'd not learnt the software, literally the Friday before and the Monday I'm on site. And that's really, really stressful.

Even though his initial experience seemed a bit stressful, his initial perceptions appeared to be proven wrong. Alan continues:

Extract Two:

..but fortunately that was another very professionally run office environment, very friendly people, which makes a massive difference.

This anecdote demonstrates quite clearly and succinctly that learning about a partner can be quite a challenge, while also trying to successfully deliver a project for a customer.

2 ANECDOTES OF FRANK (CASE STUDY SIX)

Anecdote One:

In his previous role at Company H2 Frank was asked to facilitate the introduction of a new MRP (Material Requirements Planning) system. As a lead integrator, Frank was responsible for teaching staff the new MRP system in different departments of the organisation.

When explaining the new system Frank would tell staff how the system would impact on the way they do things then he would show them the new system by demonstrating it, and then get them to try it for themselves. While reflecting on the experience however, it occurs to him that he initially assumes that people have the same understanding as him. He has discovered that it is a mistake to make these assumptions as he realises the best way to share practical knowledge effectively is to develop a common understanding with the other person. As a result, he has decided that he should not make assumptions and ensure that the other person have a grasp of the basics first. Frank takes up the story:

Extract One:

Taking a step back and kind of really sort of making sure people understand the basics before moving on, whereas, I think, when you first start trying to teach someone how to do something I guess it's a little bit like you expect them to have the same initial understanding of things and it's difficult to really see things from their perspective. So it's really sort of taking things right to the basic level and then making sure people understand that as you build up on it.

Upon demonstrating the system, Frank has learned that he has to do it in such a way that gets the other person (i.e. the student) to realise their own ability in acquiring a new skill, and become familiar with the features of the new system.

Once having gained an understanding of the basics, Frank then gets the person to demonstrate to him what they've learned. Frank continues:

Extract Two:

So it's, you know, you get someone to that point and then can you show me how to do that. And then, I guess, the follow up to that would be can you explain the reason why you've done that. Do you understand the concept behind what you're doing?

It is important to note that Frank asks the learner to explain why they are doing certain tasks, rather than copying what he did. The reason why Frank does this is because he understands that people can do things without knowing the broader purpose of what they are doing. Frank therefore thinks that it is important for people to understand why they are doing something because if they make a mistake, this will then enable them to understand the impact that it may have on others.

While reflecting on this teaching experience, Frank outlines that within his current role at Company G2, taking feedback from others has enabled him to understand how others work and also get a better understanding of how he works. This exercise has also provided Frank with the best insight into how to improve the way he works at Company G2.

When reflecting on other similar learning experiences, Frank adds that he has also learned by observing the way other "old school managers" have dealt with particular situations and more specifically, the way they have worked with people.

Anecdote Two:

Frank recalls another experience where he was required to learn production planning methods and associated systems which were going to be part of a new role that he undertook at Company H2. Frank explains further:

Extract One:

..the reason I was learning it was because we were all on one site and we were then moving to another site and all the high volume press work was what was moving, and I was moving there and going to do the production planning on that, which was being done by someone else at the time.

Production planning was an area that was completely new to Frank which involves managing people, and production plans where stock levels are calculated to produce sufficient components to be produced over a given period. Having considered all this before while undergoing his training, Frank wondered how he was going to manage the company resources to make sure that it was all in control. He did however have an initial view that if you invest the time in setting an MRP system up then that initial amount of investment should pay off in the longer term.

Frank then sat down with the company's existing production planner, who then went through the processes he used to assess stock levels and production plans. Frank takes up the story:

Extract Two:

..this is what the customer order is for next week, what needs to be done to make sure they get what they want, and then obviously it's looking at stock levels and then he went through well this is how you manage it, you know, you look at these machines, these need to run for however many hours to make that particular part, and then you need to make sure you're making that one, this is how you "juggle" the different things.

While learning the principles from the planner, Frank noticed that the person was using a spreadsheet to calculate individual stock levels then manually update the MRP system with the requirements. Frank continues:

Extract Three:

..so I followed his way of doing it and once he'd taught me how to do it and then went well this is actually what's going on and then set parameters up in your MRP system or to then do a lot of that for you.

Realising that the planner's approach was manually intensive, Frank then decided to put his faith in the system and set the parameters up on the MRP system and let it do its job automatically. I have known people adopt such ancillary working practices such as those adopted by the production planner which initially may appear unnecessary but in reality may provide an additional level of control which may not be realised by the MRP system.

Whilst the spreadsheet provided some tacit benefit of being able to more precisely calculate stock levels it is thought that a happy medium may have been to use this method periodically and update the MRP system accordingly.

Anecdote Three:
Frank explains that Company G2 recently started to make a number of variants of machine guards, all of which were similar in general configuration but had a lot of fixings. When making the guards for the first few times, the company's fitters explained to Frank that they had a hard time trying to assemble the guards due to the fact that they could not see from the drawing how the guards could be fitted.

Frank recalls that this issue kept recurring where the fitters wanted to know how to fit the machine guard configurations together. Frank explains further:

Extract One:
…and since we've been doing that, and these come up time and again, erm it's gone from like you say toing and froing, lots of questions being asked, well why am I doing this, how do I do this, I don't understand what this is meant to, you know, what do I do to make this fit together or work or whatever. Erm so we've kind of just built up a library, if you like, of the way that they want it done and the information that they want to be given.

To enable the fitters to get the job done quicker Frank decided to build up a library of parts in his CAD system that also produces a cutting list with additional details as to what fixings are required.

As a result of their initial experience, both the fitters and Frank came together a few times to discuss their requirements. Frank concludes that they are at the point where almost all of the process has been standardised, where he can input his envelope dimensions into his CAD system and automatically produce some cutting and assembly lists. Frank tells the fitters:

Extract Two:

Let's get it to a point where you're happy with everything in there, when the next time we get a machine I'll just press the print button and give you that whole pack and you should then be able to get on and do 95 per cent of it without needing to then come back and ask queries and questions.

It is noted here that by developing a shared understanding of the issues faced by the fitters, this enabled Frank to develop his CAD model to provide more practical information that would enable the fitters to make and assemble their machine guards more effectively.

4.4 CROSS-CASE NARRATIVE ANALYSIS

This sub-section presents a cross case narrative analysis for Research Questions One and Two using data identified for the core themes of *"Trust Development in Collaborative Relationships"* and *"Informal Learning".* This analysis is done using data from Case Studies One, Two and Six.

4.4.1 RESEARCH QUESTION ONE (RQ1)

In this sub-section the anecdotes of Brian from Case Study Two and Frank from Case Study Six are compared and contrasted relating to the core theme of *"Trust Development in Collaborative Relationships".*

4.4.1.1 CORE THEME: TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

The family-like culture described by Brian when recalling his experiences of working in the design office at Company I is very much similar to the tolerant values demonstrated by Frank at Company G2, where he appears to embrace and accept the incompatibility issues he has when working with his General Manager.

When considering differences between the two case studies, it is clear that the drawing office staff in Company I seemed to create a family-like culture, which would indicate that strong bonds between individuals may have existed. Brian recalls:

Extract One:

Yeah, aye. Certainly in the drawing office it was a nice tight group, we worked nicely as a team. Everybody was looked after.

Company G2 on the other hand appears to value their relationships with both internal and external partners. This is evidenced by the hardship Frank goes through to work with other colleagues who invariably use software that is compatible with his bespoke software. Frank acknowledges:

Extract Two:

It can have its moments, yeah. Because it requires just, you know, Company G2 General Manager to get everything spot on, the sizes right, the part numbers all right.

It is however acknowledged that when taking on such a role this compatibility issue would have been something that Frank would have to accommodate for when first taking on the role.

The existence and location of safety toe caps at Company O in Brian's anecdote also appeared to symbolise the company's readiness to show visitors around its plant. This demonstrated to me that Company O wanted to develop trust with potential partners at the very earliest opportunity.

Company personnel within both case studies appear to demonstrate honesty and faith, which are two characteristics that are known to develop trust. For example at Company I, the older members in the drawing office after learning about Brian's mistakes openly told Brian about a number of their mistakes which subsequently made him feel better about his situation. Brian recalls:

Extract Three:

..and they were ah what have you done wrong, let's have a look. Is that it? We've done much bigger mistakes than that, and they went through all of their mistakes and I felt much better about it because I wasn't on my own making one mistake..

Evidence of Company G2's honest working approach was found when reviewing its website where a note was found outlined that "it would not take on work if it was not 100% confident that it could do the work". A second observation made from the website was that following a rumour that Company G2 was going to make one of its flagship products (Product A) abroad, senior management decided to produce Product A at Company G2 in the UK. This appears to show that the senior management of Company G2 has faith in its staff at its Company G2 site to produce quality products.

Specific evidence of trust development in different ways has been observed in Case Studies Two and Six. For instance in Company I where a 'family-like' culture was evident, trust appeared to be developed in an affective manner, where the older members of the drawing office openly admitted to making mistakes, which may have provided Brian with personal insight into the way they work. While at Company G2, trust appears to be developed through demonstrating ability and integrity through their work, which in turn has helped them to develop their collaborative relationships. For instance evidence of a successful collaborative relationship developed by Company G2 with one of its suppliers has been observed in one anecdote where Frank describes his contract negotiation experience as being "easy, or effortless". Given that Company G2 had been working with the supplier for approximately 25 years, the negotiating experience as described by Frank is a product of many years of repeated successful transactions which has resulted in trust being developed between the two companies. Frank provides further evidence of how well the supplier company has spoken about Company G2's equipment:

Extract Four:
Erm but they speak very highly of us and the equipment that's been put in.

In addition, when negotiating a contract with the same supplier company, Frank recalls the negotiation 'framework' used:

Extract Five:

..well, it's not all…it's not particularly on price, you know. Obviously they've got a number that they're looking for and they don't want it to be way above that figure, but erm it's more the fact that we can support them with what they're doing and in the timeframes.

More specific evidence of trust development has been observed when reviewing the company group website of Company H2 where Frank worked previously. On the website it has been observed that the organisation promoted behaviours related to ethics and integrity as separate values to promote both operational excellence and social awareness. As behaviours related to ethics and integrity are considered to build trust, this would therefore imply that Company H2 may aim to build trust through both its internal and external partners.

4.4.2 RESEARCH QUESTION TWO (RQ2)

In this sub-section the anecdotes of Alan from Case Study One and Frank from Case Study Six are compared and contrasted that relate to the core theme of *"Informal Learning".*

4.4.2.1 CORE THEME: INFORMAL LEARNING

A common theme in most of the anecdotes for Case Studies One and Six is the sharing of practical knowledge with the aim of developing a common or shared understanding. This message comes out quite clearly in Case Study Six where for example Frank taught company personnel about a new MRP system. In this anecdote, Frank's teaching process appears to centre on a reciprocal exchange of knowledge where checks are made to ensure that the learner has the same understanding as himself. Frank recalls:

Extract One:

Taking a step back and kind of really sort of making sure people understand the basics before moving on, whereas, I think, when you first start trying to teach someone how to do something I guess it's a little bit like you expect them to have the same initial understanding of things and it's difficult to really see things from their perspective.

In stark contrast to Case Study Six, the learning experiences recalled by Alan are generally one-sided where he has been observed as learning about the working

practices of Company A and the products it makes. It is noted in particular that a common or shared understanding was established by Alan when learning about Company A's working practices. Alan recalls:

Extract Two:

...you're shown how to use the software...for design control as far as erm trying not to overwrite any previous work.

It is however acknowledged that a smaller amount of learning on Company's A's behalf was required to understand how to best accommodate for the way Alan works. The situation with regards learning about the products that Company A produces is somewhat more complex. It is important to note here that Company A is a first tier supplier to a number of automotive OEMs and therefore most of the products it makes are designed by the OEMs to which it supplies products. As a result, Company A may well be able to provide Alan with answers with regards to queries on existing products and product assemblies. For new products, or new design features on existing products however, Company A may well be as much in the dark as Alan, which may result in him operating within varying degrees of uncertainty. This uncertainty may well have been brought about by product assembly design changes instigated by an OEM.

The main difference in the anecdotes of Case Studies One and Six has been noted in the mode or type of informal learning that is taken place. In Case Study One, Alan tells us about how he learns about a partner and Frank in Case Study Six tells us about his experiences of how he's learnt with and from other internal staff.

Other smaller differences noted from Case Study One were observed from Alan where he describes his work as being quite stressful and trying to learn his customers working practices whilst also trying to deliver a project. In such a scenario Alan outlines two important factors that can help things when faced with such a dilemma:

Extract Three:

...but fortunately that was another very professionally run office environment, and very friendly people, which makes a massive difference.

The value of Alan's practical knowledge of CAD systems is also evident, where Company A staff regularly approached him for advice on how to use Adobe Inventor. Engineering staff do however joke with Alan about this and if they ever acquire any less common knowledge that he may not know, this may invariably be spilled. During observations after one of the Company A engineers had inadvertently told Alan about some new piece of valuable CAD knowledge, in a joke he added that *"I should have held on it, even though it's the only thing you (Alan) don't know".*

4.5 SUMMARY

Chapter Four has presented the findings of the thematic analysis and identified the core themes of *"Trust development in Collaborative Relationships*" and *"Informal Learning"* that have been used to focus the narrative analysis for Research Questions One and Two.

Using the aforementioned core themes as a guide, a narrative analysis has been conducted using example anecdotes from Case Studies One, Two and Six from the SME sub-group.

A cross case narrative analysis has then been presented, where the following significant commonalties and differences have been identified between the anecdotes that were considered as part of the narrative analysis.

Research Question One:

- Trust development between personnel in the anecdotes of one case study SME had a family type culture was found to be developed in an affective manner (i.e. based on benevolence and honesty).
- Trust development between collaborating partners where ability and integrity was found to be demonstrated in the anecdotes of one case study was achieved through repeated successful transactions over a period of time.

- In the anecdotes of two case studies, participants appeared to exhibit honesty in a number of ways, which in turn developed trust. In one anecdote, it was observed that when Brian made a mistake in his work, the older staff openly admitted to making mistakes also thereby making Brian feel better. For another company in which Frank worked, it was observed to have a note on its website where it informed potential customers that it would not take on work unless it was 100% confident that it could do the work.
- One participant, Frank appeared to demonstrate tolerance when using bespoke design software that presented incompatibility challenges, however he appeared to take this in his stride in a bid to successfully deliver a project. While there was no evidence observed of this action building trust, it is envisaged that such an action would build trust with colleagues internally and with the external collaborating partner with whom Frank works with.

Research Two:

- In a number of anecdotes it was noted that practical knowledge appeared to be shared with the aim of developing a common or shared understanding of some subject matter of interest between two people. The sharing process appeared to be characterised by a reciprocal exchange of practical knowledge where reflective checks were periodically utilised to ensure how well the understanding was aligned between each person.
- In the anecdotes of one case study the participant discussed their experiences learning with and from partners.
- In the anecdotes of one case study Alan discussed how he learned about a larger company's working practices and products, by understanding the cause and effect relationships between the two domains, which enabled him to design new pieces of equipment. In this scenario, it was noted that learning may be challenging for both partners when the products are owned and hence developed by an OEM or another company.
- In the anecdotes of one case study, one participant, Alan described his experience learning about a partner as being stressful.

CHAPTER FIVE
LARGE COMPANY SUB-GROUP NARRATIVE ANALYSIS

5.1 INTRODUCTION

Chapter Five presents the findings of the thematic analysis and a narrative analysis for two priority core themes that have been identified within the textual data for Research Question One (RQ1) and Research Question Two (RQ2). This analysis also uses data from three sample case studies for the Large company sub-group. A cross case narrative analysis is then presented where the findings are compared along with additional supporting data for Research Question One and Research Two.

5.2 FINDINGS

Tables 24 and 25 present a list of priority core themes for Research Questions One and Two for the Large company sub-group investigated in this research.

It should be noted that those core themes that had sub-themes with 10 references and above have been considered worthy of being used in the analysis. It is however acknowledged that those themes with 9 references and below may also hold some importance and therefore have also been considered when comparing the findings from each sub-group as part of the analysis of narratives in Chapter Six.

From the priority core themes listed in Tables 24 and 25, "*Trust Development In Collaborative Relationships*" with 17 references, "*Informal Learning*" with 30 references and *"Standardisation as a mechanism for Informal Learning*" with 7 references, had been chosen to provide a framework from which to conduct the case and cross case narrative analysis for Research Questions One and Two. These themes were chosen as it was noted that the same priority core themes existed for the SME sub-group thereby enabling the researcher to compare narrative data.

The core theme for Research Question Two *"Work experience undertaken"* with 60 references was not chosen, as the sub-themes and associated anecdotes provided abstract information about the participant's roles only, and not about trust and sharing of practical knowledge. It therefore was decided to choose the next core theme "*Informal Learning*", which had 30 references and one additional core theme of "*Standardisation as a mechanism for Informal Learning*", which had 7 references. Both of these themes together provided the research with an even spread of sub-themes and associated anecdotes from which to conduct the analysis.

Table 26 and 27 list the priority core themes and associated sub-themes from Case Studies Three, Four and Five within the Large company sub-group that were used in the analysis. It should be noted that one sub-theme relates to one anecdote and therefore, within this analysis it can be seen that 5 anecdotes were chosen for each research question.

All of the thematic data presented in Tables 24 to 27 can be traced back to the raw transcript data through the sub-theme and constituent code data tables that were exported from NVivo, for example see Tables 15 and 16 in Chapter Three.

5.3 SINGLE CASE NARRATIVE ANALYSIS

This sub-section presents a narrative analysis for Research Questions One and Two using data identified from the core themes of *"Trust Development in Collaborative Relationships", "Informal Learning"* and *"Standardisation as a mechanism for Informal Learning".* This analysis is done using data from Case Studies Three, Four and Five.

5.3.1 RESEARCH QUESTION ONE (RQ1)

In this sub-section the anecdotes of Colin from Case Study Two and Elaine from Case Study Five are presented, which both relate to the Core Theme of *"Trust Development in Collaborative Relationships".*

Core Theme	Refs:
Trust development in collaborative relationships	**17**
Practical knowledge sharing culture	17
Inspirational people, mentors, entities and their qualities	14
Standardisation of Working Practices as a Mechanism for Informal Learning	11
Practical knowledge disclosure	11
Informal learning	10
Sources of company competitiveness	10

Table 24 Large Company Sub-Group Priority Core Themes and References for Research Question One

Core Theme:	Refs:
Work experience undertaken	60
Informal learning	**30**
Capture and sharing of tacit practical knowledge is difficult	19
Operational systems and processes	17
Capturing and sharing of practical knowledge is highly individualistic	17
Career path	16
Practical knowledge sharing mechanisms	14
Mentor experience	13
Collaborative relationship behaviours	13
Inspirational people, mentors, entities and their qualities	12
Practical knowledge sharing promotion, classification and measurement	11
The value of practical knowledge utilised as gauge through its impact	10
Trust development in collaborative relationships	10
Practical knowledge sharing opportunities	10
Standardisation of Working Practices as a Mechanism for Informal Learning	**7**

Table 25 Large Company Sub-Group Priority Core Themes and References for Research Question Two

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 1 (RQ1)	
Case Study Three:		
End:	Trust Development in Collaborative Relationships	Transparency facilitates the development of relationships (2)
		Goodwill and benevolence plays a part in developing relationships with customers (2)
Case Study Five:		
Beginning:	Trust Development in Collaborative Relationships	Importance of getting Engineers to develop People skills which willl help them how to develop trust in Collaborative relatonships (7)
		Trust antecedents act as filters when establishing the trustworthiness of someone (2)
End:	Trust Development in Collaborative Relationships	Relational capital as a source of Collaborative Relationship development (4)

Table 26 Large Company Sub-Group Priority Core Themes and Sub-Themes Chosen for Analysis for Research Question One

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 2 (RQ2)	
Case Study Three:		
Beginning:	Informal Learning	Realisation that energy systems is an area of interest (9)
		Real-life furnace modelling as a process of learning by doing (14)
Case Study Five:		
Middle:	Informal Learning	Discussions between Engineers and Technicians about ideas as a learning experience for both (3)
		Informal learning in its various forms helps to develop people skills and systems they use (4)
Case Study Four:		
Beginning:	Standardisation as a Mechanism for Informal Learning	Standard Approaches to promoting Improvement in Product and Supplier Quality (5)

Table 27 Large Company Sub-Group Priority Core Themes and Sub-Themes Chosen for Analysis for Research Question Two

5.3.1.1 CORE THEME: TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

1 ANECDOTES OF COLIN (CASE STUDY THREE):

Colin works for himself as a combustion consultant and owns Company J1. Prior to working for himself, he has spent a significant amount of his time working for Company D1 during which time he has developed combustion technologies for a number of collaborating companies around the world. The anecdotes that Colin shared with me primarily relate to memorable experiences whilst working for Company D1, which is a large company.

Anecdote One:

Colin believes that transparency is one of the key behaviours that he looks for when developing a relationship with someone whom he may be working with. It is however, not surprising that Colin sees transparency as an important behaviour he looks for in potential partners, as he invariably works in dangerous environments when changing or installing furnace equipment. For example, when conducting tests on some new or innovative furnace equipment, Colin often has to work around a furnace after it is up to temperature (1000°-1600°C) to make adjustments to the setup. The furnace external environment therefore, may in some situations still be quite hot. Whilst working in such an environment, Colin will be wearing some heat resistant protective suit. In such a scenario for safety reasons Colin works in pairs. Colin takes up the story:

Extract One:

Yeah. And within all of that it's a bit like your divers. You kind of work in pairs. You've got your buddies. And there's guys, you can be…you can have 10 years between not having worked with somebody, but if you've worked with them in the extreme temperatures of changing out a burner where it's maybe close to 80 degrees centigrade, and the environment you're working in you keep…you're truly keeping an eye on each other, and there's a fundamental trust. And this is a really different trust.

It is noted here that Colin refers to a fundamental form of trust, which he explains further:

Extract Two:

But yeah, this is the point where you're relying on the person next to you to keep you safe and alive.

Trust is therefore referred to in this manner as two people are relying on each other to stay alive. This is in stark contrast where trust decisions or choices are made in normal day to day situations, which could be considered as being less important. Nonetheless this scenario emphasises the influence of the environment and situation awareness on informing how trust related decisions are made.

Anecdote Two:

Having established the importance of relationships in Colin's work it would therefore be logical to gain some insight into how he goes about developing such relationships. He does this by getting to know people in a social setting where goodwill and benevolence play a part in developing the relationship. By getting to know people at the personal level, this enables him to see if he can form a bond where that fundamental form of trust can be developed. He also comments that developing personal relationships in the way he does may be a challenge for some big organisations as they may not have the time or budget to support the activity. Colin takes up the story:

Extract One:

…it's one of these things that sometimes you, if you spend a couple of days with these guys and you get to know that they're either golfers, fishermen or are whatever, and they love a curry or whatever, erm they…they almost want to be seen to sometimes to impress you.

Colin acknowledges that he tries to develop personal relationships with most people he works with. This would tell me that he also is an opportunist where relationships may be seen as a source of knowledge and experience which he may need to 'tap' into at some point in the future to help him in his work.

However the main driving force of developing personal relationships is due to the practical nature of his work and the environments he works in. Colin continues:

Extract Two:

..and because of the level and things that we were doing, I was normally working with guys where you have that personal, physical trust with and you know, and I normally try and take it to the next point where you're…I've even gone for beers with one of the furnace operators, you know, because I've come down to where they live.

During the interview, Colin even acknowledges on some occasions at their suggestion he met customers at their houses. He does however stress that he doesn't want this to be seen as breaching some form of code of conduct.

2 ANECDOTES OF ELAINE (CASE STUDY FIVE):

Elaine is a knowledge manager for Company F2 that operates within the oil and gas sector. Elaine has a background in engineering but is unique from the other participants in that her role is specifically about devising strategies and systems for managing knowledge within the current company for whom she works. Elaine held a similar role in Company B2, where she worked previously, which was subsequently taken over by Company E2. Elaine's interest for knowledge management came about in her early years at Company B2, in her first role as an intellectual property and knowledge management technical author. Elaine's anecdotes mainly relate to her experiences working at Company B2, E2 and the current company she works at Company F2.

Anecdote One:

Elaine describes her work as being involved in the people side of engineering. She grew up thinking engineering was "a very structured and professional industry" however over the last 10 years or so she has seen a change in the way people should work. In her view it's more about how you win the next job while connecting better with people who you are trying to get a job from, rather than telling them explicitly how things are done or trying to coerce or force them. Elaine therefore sees her role about making connections, which she finds inspiring. She recalls one person Company E2 CEO, whose approach to working with people inspired her. Elaine explains further:

Extract One:

In terms of actually doing the knowledge management, there have been a few people such as erm Company E2 CEO, in America, who I had the chance to work with. Erm he was able to make quite technically focused people look outside of the technicalities and look more at, erm well I suppose like the emotional side of getting business, the emotional side of connecting with somebody in order, again, to get their trust so then they were receptive of the information that they were putting across.

While interviewing Elaine I acknowledge to her that it's difficult sometimes to get people, especially engineers to look outside of their own field. Like Elaine, I realise that this has become more of an important issue as technologies embrace and cut across a lot of different disciplines.

To enable engineers to work more effectively Elaine thinks that they should "look outside of their own bubble" by, for example, collaborating with somebody who has worked on a historical project that has similarities with the project that they are currently working on, or interact with somebody from another function, for example Sales in order to understand what the client wants.

Elaine's view of engineers has come from working with them in various companies. Whilst she found them inspiring from a technical viewpoint, she thought they were very stuck in their way and didn't care about the softer side of things such as connecting with other people to find out what they do and share knowledge with them. This has inspired Elaine to work in the field of knowledge management and help engineers to become more effective in the way they work. Elaine explains:

Extract Two:

So, then when I had the chance to explain through the means of the Knowledge Management Programme what we were doing, seeing those people actually change their opinion and become more effective because they've opened up or have been given the chance to work in a different way..

Anecdote Two:

Elaine's second anecdote describes in part the activity she went through to identify and select the software vendors for some knowledge management

software while working at company B2. The specific purpose of this anecdote is to demonstrate how she uses trust antecedents or “filters”, as she calls them.

Elaine tells me about her experience of searching for potential vendors online. Elaine takes up the story:

Extract One:

So, erm it’s a minefield when you look at all of these vendors and what they can do, what they can offer, and certainly that on the trust issues you read on the websites what they can do and what they’re going to offer, and then when you actually meet them you think hang on a minute. And I’m always of the mind, like it’s always in the back of my mind, but what are you not telling me? If we go down this route will there be any additional costs or nuances to the services that you’re providing, so I get annoyed with myself for approaching it in such a cynical manner..

As Elaine looks through the websites she feels the personal pressure of picking the right company because she is aware that they will be working with the company for a long period of time and tied into a contract. She doesn’t want them to make her look bad because her company’s knowledge management strategies have all been thought through and agreed by senior management. Based on this, if she did not know about the vendor’s technology and therefore didn’t know if it was going to be an exact match for her company’s strategy that they wanted to achieve, then this may result in her relying heavily on what the vendor says.

Upon selecting some software vendors, the companies were then asked to attend an interview at Company B2. After interviewing one vendor Elaine discounted them because they quoted and advertised a service that appeared to be more extensive than what was needed for the team that would be using it and what they wanted to achieve. Elaine describes this as *“buying a silver hammer to knock in a thumb tack”.*

Another vendor was discounted as Elaine felt that they just didn’t “click with them”. Elaine explains that technically on paper the proposal was good but she didn’t think her company could work with the vendor based on the way they presented themselves.

Elaine picks up the story where she describes her experience when the vendor was presenting to her and other colleagues:

Extract Two:

I mean, there's a certain element where, again thinking about my filters, if somebody is quite relaxed talking to me or quite, erm I don't know, bubbly or even if they're very erm sort of deadpan but I can hear what they're saying, erm it would make we want to work with them more. So anyway, like discounting all of my filters, and thinking about just from a business point of view, these people still didn't come across very well. I think it was partly because of the way they, I think, told us rather than discussed with us.

Elaine explains that the scenario should be referred to as a very subtle thing, where she felt the consultants weren't talking to her and it was if they were being "talked at" and it could have been the same conversation that they had with anybody. Elaine outlines that the team she worked in at the time was pretty small and needed some handholding and therefore they were really putting their faith into whichever company they awarded the work to. Elaine continues the story:

Extract Three:

It was just something in the back of our minds, and it wasn't just me at the time, it was a view that was shared with some of the Technology Managers who were there. And we just had the impression that this might go well for a week and then we'll actually run into some sort of problems.

Elaine explains that as the company was spending a lot of money and they had deadlines and a business project to achieve, it just didn't feel that they could put themselves in the software vendor's hands.

Anecdote Three:

When discussing her experience of working with a software vendor at her current company (Company F2), Elaine tells me that she got more out of the experience when she was invited by the software vendor to be on a discussion panel to talk about her experiences on using their software.

Elaine explains to me that through working out their problems together trust has developed between them. In particular, Elaine is keen to point out that she has provided the vendor with a lot of insight into a number of ways in which their product can be used within an organisational setting. In addition, she believes that Company F2 uses the vendor's software to a greater depth than any of the vendor's other customers.

Elaine is mindful that by being asked to attend such an event the software vendor may be using her to promote their software. Elaine describes her experience of the event:

Extract One:

So I didn't feel like I was being used. I felt as if I was being, erm you know, thanked, sort of respected for the experience that we've both shared

Here we can see how through working together trust has developed within the collaborative relationship between Company F2 and the software vendor. However at some point the value inherent in the collaborative relationship realised by both partners has helped to develop the relationship further in a different manner. Elaine continues:

Extract Two:

Erm and then obviously that's done wonders for my career, just meaning a bit more exposure. It's given me confidence, it's given me more…erm I know it's made the company more endearing to me now because I think we've gone beyond being two companies working together, to being actually a group of professionals achieving this particular activity that we set out on.

Based on this response it would appear that the relationship that Elaine has with the software vendor has changed to the point where she feels that the company is more endearing to her, and they can work together as a group of professionals with one purpose.

5.3.2 RESEARCH QUESTION TWO (RQ2)

In this sub-section the anecdotes of Colin from Case Study Three and Derek from Case Study Four are presented, which both relate to the core themes of *"Informal Learning"* and *"Standardisation as a mechanism for Informal Learning"*

5.3.2.1 CORE THEME: INFORMAL LEARNING

1 ANECDOTES OF COLIN (CASE STUDY THREE):

While at school, Colin found he enjoyed physics and chemistry and consequently had what he called a bizarre idea to do a Chemistry and Physics joint honours degree at a reputable university, which was difficult to get into.

Colin found the first year hard, like most undergraduates being away for the first time and realised that he found the mathematics, very theoretical. He failed the first year after trying to repeat it and at that point he left university and went to work in the civil service.

While reflecting on his experience at university, Colin realised that he had an aptitude for chemistry as this was the only exam that he passed. In addition, he made some further observations and found that he was interested in the combustion side of energy. Colin explains:

Extract One:

And so interestingly, when it came to the combustion side of Energy it was an absolute breeze.

He recalls specifically one experience of studying chemistry at university:

Extract Two:

..whereas everybody else was struggling with the fact that there was a carbon…that methane was a carbon plus four hydrogen. You know, they really just struggled with that whereas that's, you know, when you…when you had Lecturer C teaching me Organic Chemistry in first year, so combustion of methane erm is pretty simple at that point.

Upon realising that Pure Mathematics was not for him and that he had an aptitude for the combustion side of energy, this made him realise that he was more of a practical hands-on person, an engineer. Colin therefore realised that his interests were more affiliated with the applied side of science, as he liked to understand how things worked and make them "better".

Upon realising his new identity, Colin then decided to do a degree in Energy Engineering which was a sandwich course at a another university that allowed him to get some work experience. Colin explains further:

Extract Three:

So that was one of the benefits of the University, *they had a sandwich course so you had six months' work experience, so I did mine with Company A1. That was good getting some first-hand experience. But so, I say, I tried science but realised that erm I am not interested in the pure theoretical side. It's the hands-on I'm more…well perhaps more of an engineer.*

Anecdote Two:

One core activity that Colin has done throughout his career is developing furnace technology, whose primary aim is to improve the processing efficiency of glass and ceramic materials. When a new furnace has been designed it is usually Colin's job to commission the installation and sort any immediate problems that may arise. The nature of a commission may vary depending on the level of innovativeness of the technology being considered. Therefore, in the case of a highly innovative new furnace technology, Colin may be involved in testing the technology at a smaller scale at one collaborating partner's premises. Colin refers to such activities collectively as 'Real-life' modelling.

Colin is a pragmatist as he accepts that there may be several aspects of things that he doesn't understand, but accepts that they work. In having such a mindset he therefore adopts a progressive testing strategy that will enable him to gain specific insight into how a new technology behaves.

Colin provides an example of real-life modelling where he is currently developing a patent application for a technology with a collaborating partner Company I1. He tells me that the technology is more efficient than he can explain. Colin explains further:

Extract One:

I have a theory that it suppresses the foam and layer on the top of the glass and we're able to…but, you know, hell, how the hell…how can I prove something like that? I'd rather just be able

to say look you, it gives us…it's way more efficient. I think it's this reason but, to be clear, I don't know.

In such circumstances, Colin says that he applies the 80-20 rule like a heuristic for technologies that he doesn't full understand. Therefore, he may be able to attribute some proportion of an efficiency that he has calculated to some part of a set-up when conducting his tests. He does however acknowledge that his efficiency calculations are not accurate.

In using the 80-20 rule Colin also makes use of reference points as to what is best in class to understand the performance of the technology.

While Colin admits that he has never personally done any CFD modelling, he has done plenty of real-life modelling building scale furnaces to replicate and prove them. He also recalls some problems when doing this type of work with collaborating companies. When encountering such problems, to save money Colin says that he is a bit of a scrounger and tries to be resourceful in that he often walks around a factory to try and find some materials or equipment that could potentially be used as a "Plan B".

Colin recalls a specific time when some equipment wasn't operating properly and as the project was at a critical point, he was keen to take a risk and try something he hadn't done before. Colin explains:

Extract Two:

..erm we let this run and we actually sent molten refractory down the length of the furnace as we melted the block. And this is a really crude thing, and to be honest I'd never tried this before. In fact, I don't think I'd even heard of anybody doing it. But I thought well, you know, there's all these people here around this test rig, you know, and if you were to look at the cost that had been incurred getting us to that point, one guy had flown in from the States. So I said well, why don't we switch it on and off a few times and who knows, it might…it might self- equilibrate.

Colin's idea appeared to work and by trying a few additional things the team managed to develop the molten refractory in the way they wanted. Colin continues:

Extract Three:

But the credibility we got, because we didn't spend any extra money, but we continued and at least we tried different things to see, you know, and as I say, I wouldn't recommend it as the optimum way to develop a block, but we did reach a point where it stopped melting.

The development team therefore gained credibility by being able to get the desired results at no additional cost to any of the partnering companies.

2 ANECDOTES OF ELAINE (CASE STUDY FIVE):

Anecdote One:

In this anecdote Elaine recalls an initiative at Company B2 which enabled the company to develop its organisational memory by getting personnel to share their experiences. She did this by getting a small number of technology development engineers in a room with some of the company's technicians who would be involved in building the prototypes, or other associated equipment that the technology development engineers would be developing. Elaine explains some of the key features of the event:

Extract One:

Erm we very much, through the knowledge management strategy, …got a mix of people in a room because actually it's going to benefit you as the person erm developing that knowledge, because somebody who didn't know about it would ask the "stupid" questions.

During the event, discussions would therefore take place where the technology development engineers would explain what projects they were working on to the technicians, invariably however their thoughts may not be fully developed. Upon explaining their ideas, the technicians would then ask the "stupid questions" that would prompt them to further think about their ideas. The knowledge exchange would therefore promote informal learning, particularly where the discussion prompted both parties to think more deeply about the subject matter that was being considered. Elaine describes the technicians' "stupid questions" act as a 'fishhook' to the technology development engineers. Elaine explains further:

Extract Two:

…it's like a fishhook, like sometimes I think it's like chucking some bait to the subject expert and chucking the right bait to prompt a thought which then helps guide their thoughts. Experts need help in articulating all of that stuff that's in their head that is a big jumbled mess. I'm saying a jumbled mess, to somebody from the outside, but internally it makes a lot of sense [to them]…

Elaine provides some interesting insight into knowledge sharing between experts and non-experts. The notion of getting subject experts to share ideas with other personnel, who may not be a subject expert, would enable them to make sense of key 'discontinuities' within their ideas. In doing so, this would also enlighten other personnel as to what developments they are working on and therefore benefit both parties.

Anecdote Two:

While interviewing Elaine it is easy to see the passion she has for getting companies to realise the benefits from sharing knowledge. Elaine takes up the story:

Extract One:

..I think it's the one thing that probably keeps me awake at night as to this is actually happening in at all businesses, all of these closed conversations that actually if you could just open it up to – I'm saying everybody in the business – no, if you could clear away those boundaries how much more effective could individuals be if they had the knowledge to do their job.

She acknowledges that you can't 'tap' into every conversation and it's too much to ask an employee to do research before they do every job. She further informs me that companies within the oil and gas sector can't afford to pay for their employees to undertake structured learning. In addition they don't have the time to do it as they're trying to win work and gets jobs done for their clients. Elaine therefore tries to identify opportunities for her team members to learn on the job.

Elaine provides an example of how she gets her team members to build a team site using knowledge management software whilst learning from the experience:

Extract Two:

I would give my team like an activity to do, so together, for example, we would build a team site on Software Product B and then I would, you know, tell them to go away and do it through practice, and then we would discuss it afterwards…and every time we come across a problem we would document it on our Software Product B blog, so instead of emailing each other or even getting together at that point in time, we would document it in our blog and then we would each comment on it and, you know, get to a solution that way over time. So, it then became informal learning for new team members. When they had the same problem they could read our experience and then reproduce it.

During the course of the interview, Elaine outlines other methods of capturing knowledge where informal learning can be realised through reusing the knowledge captured from historical projects. One such way of doing this is through populating a lessons learned database. Elaine tells me that she's had quite a lot of experience implementing such systems. Elaine explains further:

Extract Three:

Erm so we've gone through quite a [learning] curve with organisations of explaining what is a lesson learnt, how is it best to manage it, why should you manage lessons learned, and even like hearing myself saying these terms about managing lessons learned, it's complex and it doesn't really do it justice for the importance of learning from experience.

In outlining that people's knowledge is too complex to record in simplistic terms, Elaine is in fact implying that by capturing knowledge for the purposes of learning, the tacit element and hence some, or most of its meaning may be lost. Elaine then recalled her experience of implementing a lessons learned database at Company B2 where she encountered a number of difficulties. First of all, even though she had taken the time to explain the importance of recording key lessons learned, staff couldn't see how other people would benefit from using them. Secondly, the system was not integrated into the flow of the company's operations and therefore it was viewed as an extra task on top of their day job, to populate it.

In outlining some of the ways knowledge can be captured and managed it is evident that some ways are more effective than others. In addition to this, if the

method helps to capture knowledge effectively, then this may also help people to learn on the job, while also developing the systems that are being used.

5.3.2.2 CORE THEME: STANDARDISATION AS A MECHANISM FOR INFORMAL LEARNING

1 ANECDOTES OF DEREK (CASE STUDY FOUR):

Derek currently works at Government Department E and has previously worked in various roles as a manufacturing engineer at Company O1 in the defence sector and Company C which operates within the automotive sector. The anecdotes of Derek relate to experiences that relate to his time working at Company O1 and Company C, which are both large companies.

Anecdote One:

In his experience in both the automotive and aerospace sectors, Derek has found that there is far less willingness to have “residual knowledge” residing within the heads of employees of an organisation. To explain his point, Derek provides an example of a typical system such as APQP (Advanced Product Quality Planning) that is used by companies within the aforementioned industry sectors. Derek explains that systems like APQP are geared up to document and standardise the way key or breakthrough product and process characteristics are identified and used by employees, or production operatives. Derek explains the key features of an Advanced Product Quality Planning (APQP) system:

Extract One:

APQP, or Advanced Product Quality Planning, it is all about, you know, you must document your method, you must standardise your method, you must have process control plans, you must identify the critical component control features and process parameters.

Derek comments that portable, standardised processes have come about as a result of the need for companies to be agile in the way they manufacture their products. By having such a set-up this enables OEMs to move components between suppliers, as the standard working practices used would enable them to hit the ground running so to speak.

While working at Company O1, Derek often audited suppliers against the standardised work that they were supposed to do. He explains what happened if he found that they were hiding or concealing knowledge.

Extract Two:

..if we find a supplier is hoarding or concealing insight and knowledge about how a process works, that's a big problem for us because it means that if we are to move that component it will take the new supplier much longer to master it.

In industry sectors like aerospace, where operations have a long lead time, Derek tells me that they could not afford disruptions to production where they might need to scrap components as the supplier develops their process capability. Derek is however keen to point out that working practices appear to be more formalised and structured in the aerospace and automotive industry sectors.

Residual knowledge within the context that Derek refers to here is therefore non-standard knowledge, or knowledge that is not related to standard working practices. While such residual knowledge may be viewed as being undesirable, upon identifying such knowledge this provides a company with an opportunity to learn about a cause of variability in their process. In addition, most companies that use quality systems like those outlined by Derek generally use these as an opportunity to continuously improve their working practices.

5.4 CROSS-CASE NARRATIVE ANALYSIS

This sub-section presents a cross case narrative analysis for Research Questions One and Two using data identified for the core themes of *"Trust Development in Collaborative Relationships", "Informal Learning"* and *"Standardisation as a mechanism for Informal Learning".* This analysis is done using data from Case Studies Three, Four and Five.

5.4.1 RESEARCH QUESTION ONE (RQ1)

In this sub-section the anecdotes of Colin from Case Study Three and Elaine from Case Study Five are compared and contrasted that relate to the core theme of *"Trust Development in Collaborative Relationships".*

5.4.1.1 CORE THEME: TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

Colin's first two anecdotes are both related in that they demonstrate how trust is influenced by the nature of his work and the hazardous environments that he works in when commissioning scale furnaces.

It has also been noted that the way collaborative relationships are developed are different. In Colin's second anecdote for example, a personal relationship was developed with the aim of developing a strong bond so he can feel comfortable working with partners in potentially hazardous environments. In order to develop this personal relationship, Colin does this within a social setting with the aim of getting to know a person in a way which provides him with more intimate insight into who they are as people outside of work, for example getting to know about their hobbies and pastimes. Colin explains further:

Extract One:

...it's one of these things that sometimes you, if you spend a couple of days with these guys and you get to know that they're either golfers, fishermen or are whatever, and they love a curry or whatever, erm they…they almost want to be seen to sometimes to impress you.

While in Elaine's last anecdote the collaborative relationship was seen to be developed through working together, where they worked through issues that were faced when using the knowledge management software. Elaine continues the story:

Extract Two:

Because of obviously they've got trust in me now because through the way we've discussed things, we've worked out problems, I've given them a lot of insight into how their product is used in my company for knowledge management..

The value of relationships is a core theme that is reflected in Colin's second anecdote and Elaine's last anecdote. It is however noted that the way in which the value in the relationships are realised is different. Colin for example appears to be interested in getting to know the values and beliefs of his partners based on their life experiences, as he is interested in getting to know people on a more personal level. As Colin is looking to put his life in the hands of his partner, he therefore looks to develop a fundamental form of trust so they can rely on each other. Colin explains further.

Extract Three:

..but if you've worked with them in the extreme temperatures of changing out a burner where it's maybe close to 80 degrees centigrade, and the environment you're working in you keep…you're truly keeping an eye on each other, and there's a fundamental trust. And this is a really different trust. But yeah, this is the point where you're relying on the person next to you to keep you alive.

In Elaine's anecdote however, it would appear that the software vendor realised the value of Elaine and her team's experience in applying their knowledge management software in different ways over a period of time. As a result, this value may have become evident to the software vendor, as Company F2 reported on the challenges that they faced when using the software. The value of Company F2's practical knowledge to the software vendor is evidenced when Elaine is asked to attend the discussion panel event.

It was noted that the types of trust reflected in the three case studies have some differences and similarities. For example, the type of trust in Colin's anecdotes is primarily based on personal safety issues, which he calls a 'fundamental or physical form' of trust. In both Colin's and Elaine's anecdotes, the trustworthiness of partners appeared to be established on the way they presented themselves, where an affective form of trust based on goodwill and benevolence was seen. For example, it was noted that Colin developed personal relationships based on goodwill and benevolence when socialising with potential partners.

While it would appear that goodwill and benevolence were evident in the relationship Elaine has with the current software vendor she is working with, after they invited her to a discussion panel event this would indicate that their relationship has entered into a new phase. Elaine explains things further:

Extract Four:

I felt as if I was being, erm you know, thanked, sort of respected for the experience that we've both shared. Erm and then obviously that's done wonders for my career, just meaning a bit more exposure. It's given me confidence, it's given me more…erm I know it's made the company more endearing to me now because I think we've gone beyond that being two companies working together, to being actually a group of professionals achieving this particular activity that we set out on.

Specific evidence of the usage of trust antecedents, or as Elaine calls them "filters," was witnessed in Elaine's second anecdote, when describing her experience of interviewing one software vendor as part of a tendering exercise whilst working at Company F2. In particular it was noted that the selection of trust antecedents were based on subtle behavioural responses noted by Elaine when observing the way, or manner in which the software vendor delivered their presentation to Elaine during the course of the interview. For example, Elaine recalls how the software vendor spoke to them when being interviewed:

Extract Five:

It was a very subtle thing. Erm they also seemed as if they weren't talking to us, they were talking to a customer, and it could have been the same conversation that they had with anybody before.

Based on the general content used in the software vendor's presentation, it is envisaged that Elaine and her team deducted that the vendor hadn't bothered to find out the specific nature of Company F2's business and their requirements, thereby demonstrating a lack of ability and integrity.

Elaine's first anecdote is unique in that she is the only participant to outline that engineers need to develop people skills so that they can 'make connections' or share practical knowledge effectively. This anecdote holds cultural implications as it is viewed that people like engineers who primarily work with numbers feel

comfortable dealing with subject matter that are clear and concise. Of course, softer issues that are people related may be viewed as being exactly at the opposite end of a 'spectrum of abstraction or clarity'.

In outlining her view of engineers, Elaine provides an example of a colleague Company E2 CEO, with whom she work shadowed, and the way he could get technical members of staff to see the 'people' side of a given point that he was trying to make. Elaine explains further:

Extract Six:

Company E2 CEO, in America, who I had the chance to work with. Erm he was able to make quite technically focused people look outside of the technicalities and look more at, erm well I suppose like the emotional side of getting business, the emotional side of connecting with somebody in order, again, to get their trust so then they were receptive of the information that they were putting across.

5.4.2 RESEARCH QUESTION TWO (RQ2)

In this sub-section the anecdotes of Colin from Case Study Three and Derek from Case Study Four are compared and contrasted that relate to the core themes of *"Informal Learning"* and *"Standardisation as a mechanism for Informal Learning".*

5.4.2.1 CORE THEME: INFORMAL LEARNING

One common theme identified, relates to the learning processes used by Colin in his second anecdote, and the technology development engineers as described by Elaine in her first anecdote.

In Colin's second anecdote, when conducting 'real life' modelling and developing novel technologies that are not well understand, he applies some simple guidelines to help understand what's going on. Colin explains further.

Extract One:

And every time we do it, it works. So, you know, some…so within there erm I'm happy that to just know that erm something works and I'm happy to apply and the 80/20 rule as well, if that makes sense.

Colin therefore applies the 80-20 rule to identify and apportion his efficiency calculation(s) to parts of the equipment set up used, which he terms ‘reference points’.

Both the ‘stupid questions’ in Elaine’s anecdote and reference points in Colin’s anecdote serve a similar purpose as they both act as reference points to break the experience up so that it can then be analysed from different perspectives.

In the case of Colin’s anecdote, upon breaking the experience down into smaller constituent parts, each one is compared to a specific piece of work that may be considered as best in class technologies to produce some guesstimate efficiency calculations. In Elaine’s first anecdote, the stupid questions posed by the technicians, prompt or guide the technology development engineers to think of their experience in a specific way. Elaine explains:

Extract Two:

And I think with somebody who’s got all of the knowledge in their head, you’d need some sort of, it’s like a fishhook, like sometimes I think it’s like chucking some bait to the subject expert and chucking the right bait to prompt a thought which then helps guide their thoughts.

After breaking their experiences down, the technology development engineers may not necessarily consider best in class work as noted in Colin’s anecdote, however it is acknowledged that benchmarking is considered to be standard practice when developing new technologies in most engineering companies.

Some interesting insight is provided by Elaine when describing the subject expert’s thoughts as being ‘ordered’ to them, but when being shared with non-subject experts may seem a ‘jumbled mess’. Elaine outlines how the stupid questions posed by the technicians may function like a ‘fishhook’ to help the engineers to sort out their thoughts:

Extract Three:

Experts need help in articulating all of that stuff that's in their head that is a big jumbled mess. I'm saying a jumbled mess, to somebody from the outside, but internally it makes a lot of sense [to them]…

In this scenario, it is important to note that tacit knowledge may be shared, however quite interestingly the non-subject expert may not know this until their understanding of the subject area has developed and at that point it would take on some form of meaning to them.

Another common theme identified relates to personal learning experiences. In Colin's first anecdote this relates to the discovery and development of his own personal identity. Another personal experience has been identified from Elaine in her third anecdote where she describes how she implemented a lessons learned database.

Both anecdotes are similar in that both participants sense of self and personal view are challenged which results in some new position being adopted. In Colin's first anecdote his initial view of himself was that he should undertake a career that required both Chemistry and Physics. Upon finding the Mathematics too theoretical and passing the Chemistry exam only, Colin realised that his strengths were in the combustion side of energy. Colin takes up the story:

Extract Four:

And so interestingly, when it came to the combustion side of Energy it was an absolute breeze. And it was strange how the University experience sort of helped me. And, you know, I found that realistically I was an engineer. You know, I liked to understand things, you know, why, how they work, you know, it's smart, and how can I make them better.

While working in a previous role promoting knowledge management systems at Company B2, Elaine was responsible for implementing a lessons learned database. She tells me that prior to implementing such a system Elaine informed the company staff members of the purpose and benefits of using such a system. Elaine explains:

Extract Five:

Yeah. I think overall the sort of experience I've had with lessons learned in organisations, that that would probably cover a few stories there. Erm so we've gone through quite a [learning] curve with organisations of explaining what a lesson learnt is, how is it best to manage it, why should you manage lessons learned.

Following a period after the database was implemented; it was observed that most staff did not buy into the system as they couldn't see how recording project data could benefit them going forward. In addition to this, the way in which the database had to be completed made the engineering staff feel that it was not integrated into their daily operations and viewed it as an extra task that they did not want to fulfil.

After going through this experience, Elaine gives her thoughts on how well she thinks the lessons learned database captured the practical knowledge used by engineers on projects:

Extract Six:

..and even like hearing myself saying these terms about managing lessons learned, it's complex and it doesn't really do it justice for the importance of learning from experience.

Elaine now has a different view of lessons learned databases, where such systems should be implemented with the full support from senior management, and designed so that they are fully integrated in to a company's existing operations.

5.4.2.2 CORE THEME: STANDARDISATION AS A MECHANISM OR INFORMAL LEARNING

Elaine's second anecdote and Derek's anecdote together demonstrate how opportunities to conduct informal learning activities can be identified in a company's daily working practices.

In Elaine's second anecdote she describes how an environment is created for her team members to learn on the job, by creating a website and chronicling their

actions in a blog where they receive feedback from other team members. While the opportunity to conduct informal learning in Elaine's anecdote appears to be welcomed, the opposite appears to be evident in Derek's anecdote.

It is in Derek's anecdote that the identification of what he calls 'residual knowledge' is undesirable when for example auditing suppliers, Derek explains further:

Extract One:

When I've audited suppliers against standardised work, that is their standard processes of what you must do, and if we find a supplier is hoarding or concealing insight and knowledge about how a process works, that's a big problem for us because it means that if we are to move that component it will take the new supplier much longer to master it.

The identification of residual knowledge however is the trigger point to examine working practices where informal learning may take place. In this scenario, while it is recognised that the opportunities to learn informally may be less frequent and unplanned unless a company has an extensive continuous improvement programme, in which case the opportunities to learn on-the-job would be sought on a periodic basis.

5.5 SUMMARY

Chapter Five has presented the findings of the thematic analysis and identified the core themes of "*Trust development in Collaborative Relationships*", *"Informal Learning"* and *"Standardisation as a mechanism for Informal Learning"* that have been used to focus the narrative analysis for Research Questions One and Two.

Using the aforementioned core themes as a guide, a narrative analysis has been conducted using example anecdotes from Case Studies Three, Four and Five from the Large company sub-group.

A cross case narrative analysis has then been presented, where the following significant commonalties and differences have been identified between the anecdotes that were considered as part of the narrative analysis.

Research Question One:

- The type of trust and collaborative relationship formed was noticeably different in two case studies. For example in the anecdotes of Colin it was learned that due to the hazardous environments in which he works, he preferred to get to know his partners on a personal level and therefore developed personal relationships with them. The type of trust developed was noted to be a "fundamental" form of trust based on personal safety considerations. In the anecdotes of Elaine it was noted that collaborative relationships were developed by working through software issues that were encountered over a period of time. Trust in this instance appeared to be based initially on ability.
- In the anecdotes of both Colin and Elaine, their collaborative relationships appeared to be based on both goodwill and benevolence. In the case of Elaine, however it was noted that goodwill and benevolence appeared to develop over a period of time with the software vendors that she collaborated with.
- The way value of the collaborative relationships was realised within the anecdotes of Colin and Elaine was noted with following notable differences:
  - Colin appeared to attribute value in personal relationships based on life experiences of his partners.
  - In Elaine's anecdote it appeared that the software vendor realise the value of Elaine's experience in applying the software in different ways.
- In one of Elaine's anecdotes, the utilisation of trust antecedents or "filters" was observed as being a very subtle process based on observation of behavioural responses of a potential partner.
- Based on her experiences of implementing knowledge management systems, Elaine felt that engineers needed to develop people skills so that they could share practical knowledge more effectively. In discussing this, she provided an example of one person with whom she worked who could get technical people to see the "emotional side" of project issues.

Research Two:

- In the anecdotes of Colin and Elaine, the learning processes used to develop new technologies were described in simplistic terms. Both approaches described appeared to be similar in that they both used reference points to break their experience down to reflect and analyse it from different perspectives.
- Two anecdotes appear to describe the personal learning experiences of Colin and Elaine. In the case of Colin, this related to his realisation that he had an interest in the combustion side of energy. Elaine however recalled her experience in using a lessons learned database which she found to be not suited to the working practices of a previous company she worked in.
- In the anecdotes of Elaine and Derek, the degree to which informal learning can be integrated into a company's daily activities was observed. In Elaine's anecdote, she described how she got her team to build a website and chronicle the experience in a blog, which gave other team members the opportunity to discuss any issues that were encountered. Informal learning in this experience appears to be fully integrated into the company's daily activities. Derek on the other hand refers to the standardisation of company processes, where opportunities to learn are based on the identification of residual knowledge. Informal learning done in this manner may be less frequent unless a company has a system that promotes continuous improvement, in which case such informal learning opportunities would be identified in a more purposeful and systematic manner.

CHAPTER SIX
COMPARISON OF SME AND LARGE COMPANY SUB-GROUPS

6.1 INTRODUCTION

Chapter Six compares the findings from the cross-case analysis for both company sub-groups, using a form of analysis of narratives. Additional or ancillary core themes have been included to draw in important observations that had a similar or lower number of references identified in the thematic analysis.

For Research Question Three, a method called narrative mapping is used to conduct a form of analysis of narratives for each of the four relationship phases as identified in this research. The aim of using such maps is to understand more specifically how the trustworthiness intensions of the trustor influence the sharing of practical knowledge, and how such intensions are demonstrated by the trustee. Note that the items mapped are based on the textual data collated using the interview transcripts, observation notes and field notes generated by this research. The findings of the analysis are then compared and contrasted with the literature.

6.2 FINDINGS

The analysis of narratives presented is based on a comparison of the findings from the cross-case narrative analysis from both the SME and Large company sub-groups and contrasted with the literature. A number of additional or ancillary core themes have been chosen to supplement the aforementioned analysis to include important observations that had a similar or lower number of references. The importance of an ancillary core theme was determined if it had strong relationship with a priority core theme, or its relevance to answering a research question from a theoretical perspective.

Tables 28 to 31 present a list of ancillary core themes for Research Question One and Research Question Two that had been chosen to provide a framework from which to conduct the analysis of narratives for both sub-groups.

From the aforementioned tables it should be noted that the core theme of *"Impact of environment on the development of trust and collaborative relationships"* with 38 references in the SME sub-group was chosen due to the number of references it had, and similarities it shared with anecdotes within the Large company sub-group for Research Question One. The core theme of *"Practical knowledge sharing culture",* which existed within both sub-groups, was also chosen as this was identified as being particularly important to answering Research Question One. The core theme of *"The value of sharing Practical knowledge is gauged through its impact"* with 7 references in the Large company sub-group was also considered important to theory development with respect to Research Question One.

The core theme of *"Capture and sharing of Tacit practical knowledge"* with 19 references in the Large company sub-group was chosen due to the number of references it had, and it was also observed that the SME sub-group had a similar core theme of *"Sharing of Tacit practical knowledge"* with 1 reference in the SME sub-group. For the purposes of the analysis both themes were compared under one theme of *"Capture and sharing of Tacit practical knowledge".* The core theme of *"Practical knowledge sharing mechanisms",* which existed within both sub-groups, was also chosen as it was identified as being particularly important to answering Research Question Two.

Tables 32 to 35 present the ancillary core themes and associated sub-themes for both sub-groups that were used in the analysis. It should be noted that one sub-theme relates to one anecdote and therefore, within this analysis it can be seen that 4 anecdotes (two from each sub-group) were compared for each research question.

6.3 RESEARCH QUESTION ONE (RQ1)

In this sub-section anecdotes from both the SME and Large company sub-groups which both relate to the core theme of *"Trust Development in Collaborative Relationships"* are compared and contrasted with the literature. Anecdotes related to ancillary core themes are then compared and contrasted in a similar manner.

Core Theme	Refs:
Impact of environment on the development of trust and collaborative relationships	38
Practical knowledge sharing culture	1

Table 28 SME Sub-Group Ancillary Core Themes and References for Research Question One

Core Theme:	Refs:
Sharing of Tacit practical pnowledge	1
Practical knowledge sharing mechanisms	12

Table 29 SME Sub-Group Ancillary Core Themes and References for Research Question Two

Core Theme	Refs:
The value of sharing practical knowledge is gauged through its impact	7
Practical knowledge sharing culture	17

Table 30 Large Sub-Group Company Ancillary Core Themes and References for Research Question One

Core Theme:	Refs:
Capture and sharing of Tacit practical knowledge	19
Practical knowledge sharing mechanisms	14

Table 31 Large Company Sub-Group Ancillary Core Themes and References for Research Question Two

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 1 (RQ1)	
Case Study One:		
End:	Impact of environment on the development of trust and collaborative relationships	Working environments that promote and inhibit the development of Trust and Collaborative Relationships (21)
Case Study Six:		
Middle:	Practical Knowledge Sharing Culture	Developing a broad capability through a Practical Knowledge Sharing Culture (1)

Table 32 SME Sub-Group Ancillary Core Themes and Sub-Themes Chosen for Analysis for Research Question One

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 2 (RQ2)	
Case Study Six:		
Middle:	Sharing of Tacit practical knowledge	Learning Production Planning through the sharing of Tacit Practical Knowledge (1)
Case Study One:		
Beginning:	Practical Knowledge Sharing Mechanisms	Effective and Ineffective use of Practical Knowledge Sharing Mechanisms such as Hand Sketches (8)

Table 33 SME Sub-Group Ancillary Core Themes and Sub-Themes Chosen for Analysis for Research Question Two

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 1 (RQ1)	
Case Study Five:		
End:	The value of sharing practical knowledge is gauged through its impact	Value in sharing Practical Knowledge (6)
Case Study Five:		
End:	Practical Knowledge Sharing Culture	Range of activites required to promote a Practical Knowledge sharing culture (14)

Table 34 Large Company Sub-Group Ancillary Core Themes and Sub-Themes Chosen for Analysis for Research Question One

Case Study No:	Core Themes:	Sub-Themes (Refs):
Story Phase	Research Question 2 (RQ2)	
Case Study Five:		
Middle:	Capture and sharing of Tacit practical knowledge	Capturing and Sharing of Tacit Practical Knowledge is difficult to undertake (19)
Case Study Five:		
Middle:	Practical Knowledge Sharing Mechanisms	Discussion forums provide opportunities to share practical knowledge about different topics (12)

Table 35 Large Company Sub-Group Ancillary Core Themes and Sub-Themes Chosen for Analysis for Research Question Two

6.3.1 CORE THEME: TRUST DEVELOPMENT IN COLLABORATIVE RELATIONSHIPS

One similarity identified within a number of anecdotes of both sub-groups was the affective nature of the culture within the organisations that participants worked in. For example, a family type culture was found to be evident in Company I in the anecdotes of Brian within the SME sub-group. This type of culture is typically known as a clan culture, which is defined by Kerr and Slocum (1987) as a fraternal group, where the relationships among members are characterised by the following items:

- Pride in membership.
- Sense of interdependence and identification with peers.
- Extensive collegial network.
- Stresses as a collective rather than as an individual initiative.

In a number of anecdotes of both sub-groups, trust antecedents that are commonly known to develop affective trust were also observed. For example, goodwill and benevolence was shared by Colin when developing collaborative relationships with partners with whom he worked. It is noted from Lewis and Weigert (1987) that goodwill and benevolence are common trust antecedents which develop an affective form of trust.

Goodwill and benevolence also appeared to be evident in the relationship Elaine developed with the current software vendor she is working with. After being invited to a discussion panel event however, this indicated that their relationship had entered into a new phase where she describes herself as being endeared to the software vendor. This appears to be similar to the knowledge based relationship phase as identified by Lewis and Bunker (1996), which is predominantly based on cognitive trust.

Transparency was also identified by Colin as an important behaviour that he liked to see in his partners. It is noted from Urban, Sultan and Qualls (2000) that transparency is a common trust antecedent that develops trust. This type of

behaviour was also evident in Company I, when Brian recalled how he made a mistake and the older colleagues demonstrated transparency and honesty when outlining mistakes that they had made previously. Similar, trust based behaviours were identified when reviewing Company G2's website where honesty and faith appear to be demonstrated. Honesty was demonstrated where the company made a note that they would not commit to do work unless there are sure that they could undertake it. Like the other trust antecedents mentioned, honesty is recognised as a common behaviour that develops trust (Chow and Holden 1997). Company G2 senior management also appeared to demonstrate faith in its workforce when it was rumoured that a flagship product (Product A) was going to be made abroad, however the decision was made to make the product at Company G2 in the UK.

On recalling his experiences at Company G2, Frank appeared to demonstrate tolerance on facing software compatibility issues when sharing CAD data with other internal colleagues when collaborating together. Tolerance is not reported as a trust antecedent however fairness, which is a similar behaviour, has been reported by (Dyer and Chu 2000).

There also appears to be some similarities in the way collaborative relationships are developed. For example, in Case study three Colin developed personal relationships within a social setting with the aim of developing a strong bond. Trust developed in this manner is similar to that of affective trust as observed by Lewis and Weigert, (1985). It was however noted that Colin did this mainly due to the hazardous nature of his work as he likens his work to deep sea diving where people work in pairs. The relationships referred to in Brian's anecdote at Company I also appear to be developed in a similar manner; however it was evident that this was not done within a social setting.

Trust development in collaborative relationships based on ability and integrity also appeared to be evident in both sub-groups. Both ability and integrity are two of the most commonly cited trust antecedents noted by Mayer, Davis, and Shoorman (1995). For example in Elaine's anecdote it was observed that trust was developed initially with the current software vendor through solving problems

together. This was also evident in one of Frank's anecdotes where he described his contract negotiation experience as being 'effortless'. Given that the supplier had been working with Company G2 for 25 years it is envisaged that their collaborative relationship, like Elaine's is based on repeated transactions over a period of time. Repeated transactions have been identified from Gulati (1995) as a key characteristic of trust based relationships.

Bandura (1978) offers insight into how trust antecedents are related to culture through the model of reciprocal determinism. He observes that human behaviour determines the social environment and physical world and vice versa. It is noted here that culture can be viewed as the implicit aspect of the human social environment, as defined by Barnett and Casper (2001) as *"the immediate physical surroundings, social relationships and cultural milieus within which defined groups of people function and interact".*

The value attributed to collaborative relationships was also found to be important in both sub-groups, however this was found to be more evident in the large sub-group where such value was realised in different ways. For example Colin appeared to be interested in getting to know the values and beliefs of his partners based on their life experiences and on a more personal level. In Elaine's anecdote however it was observed that the software vendor valued her team's experience in applying their knowledge management software in different ways, over a period of time. The value of Company F2's practical knowledge is evidenced when Elaine is asked to attend the discussion panel event.

The value attributed to collaborative relationships in the SME sub-group was evidenced indirectly in Brian's anecdote where he appears to value the feedback and wisdom that he received from his older colleagues whilst working as a trainee at Company I. Indirect evidence of the value placed on relationships with external partners was noted by the software compatibility issues encountered by Frank to get a job done.

The above observations demonstrate that the value of collaborative relationships can be realised in different ways depending on how trust is developed. The value

of collaborative relationships is typically recognised as social capital developed through accessing resources and economic opportunities (Coleman 1988). It is also important to note that researchers have observed that working relationships based on mutual trust tend to exhibit more social capital (Kale, Singh and Perlmutter 2000).

Unique to the Large company sub-group is the type of trust developed by Colin which is primarily based on personal safety considerations due to the hazardous environments he works in. As a result, Colin looks to form a strong bond with his partners by developing a personal relationship initially within a social setting. Strong interpersonal relationships are noted by Cetin, Fernandez-Zubieta and Mulatero (2016) as a key characteristic of informal social capital, which is often used by entrepreneurs to develop trust and gain access to various types of resources.

Given that an organisation's culture influences the processes that create new knowledge, legitimises and distributes it in organisations as noted by De Long and Fahey (2000), the above observations imply that trust plays a key role in this translatory process of realising value in sharing knowledge.

Another unique item observed within Elaine's anecdotes relate to the usage of trust antecedents, or as Elaine calls them "filters" when describing her experience of interviewing a software vendor whilst working at Company F2. In particular it was noted that the selection of trust antecedents were based on subtle behavioural responses noted by Elaine when observing the manner in which the software vendor delivered their presentation during the course of the interview. The manner in which the trust antecedents are selected appears to agree with the way Lewicki and Polin (2013) outline how trust antecedents are used when negotiating with a partnering company.

While interviewing Elaine, she also outlines that engineers needed to develop people skills that will enable them to share practical knowledge effectively. Darling and Dannels (2003) agree with this view and add that as practicing engineers' daily work is characterised by more interpersonal and small group

experiences, communication skills are vital. When outlining her view, Elaine provides an example of Company E2 CEO with whom she work shadowed, and observed the way this person could get technical people to see the social perspective of a work-related issues.

The importance of communication is realised through organisational culture by Hatch (1993) who defines it as a dynamic process used to transform objects, words and actions into symbols.

6.3.2 ANCILLARY CORE THEMES

In this sub-section anecdotes that relate to the ancillary core themes in both the SME and Large company sub-groups are compared and contrasted with the literature.

6.3.2.1 IMPACT OF ENVIRONMENT ON TRUST DEVELOPENT AND COLLABORATIVE RELATIONSHIPS

The influence of the working environment was identified as being an important factor in both the SME and Large company sub-groups, where three radically different types of environment were observed and described by Alan and Colin.

First, Alan in his 'Harry Potter' office, which has been converted from a cupboard in his house, secondly the large open plan office in Company A. Third, the hazardous potentially life-threatening environment that Colin often works in when commissioning scale furnaces. Colin's anecdote is considered as the nature of the environments he often works in influences how he develops relationships.

Prior to conducting observations at Company A, I was given a quick tour round Alan's house and in particular he showed me his office, a converted cupboard, which Alan called his 'Harry Potter' Office due to its size. It was around 5 feet square and 7 feet high, with two shelved walls crammed with books and DVDs.

Whilst observing Alan at Company A later, I ask him to outline four ways that he would use to describe his working environment at home. These are outlined as follows:

- I sometimes listen to an audio book while working.
- I often work throughout the day without having lunch.
- I do not notice things outside of the office.
- I feel lonely (i.e. isolative).

After reflecting on Alan's comments I thought that this environment is not conducive for promoting a culture of knowledge sharing primarily because he is working on his own. However Alan may be forgiven, as he works here infrequently. Alan's comments indicate that he is able to focus and get down to some serious work, which given the busy work schedule he has may be a good thing.

The working environment of Company A, a large automotive supplier where Alan works most often is in stark contrast to the small office that he has at home. The main office, where most engineering personnel are based is large and open plan.

The open plan layout of the office is such that the desks are arranged in groups for engineers who work on similar areas of the plant, with their manager placed at the head of each group. Alan shares a desk with a number of Company A engineering staff and because of his close proximity, staff could discuss design issues or share a joke with him.

The notion of visibility comes from the work of Suchman, (1987) who has studied the relationship between situation, action and planning. Taking this perspective, the multidimensional nature of communication becomes evident in Company A where socially mediated work is made visible due to the open plan layout of the office. Whilst most people are using computers, communication takes on a less

visible format, with Alan using CAD software to design solid models of various jigs.

Thus it has been observed that the environment at Company A fostered opportunities to share various forms of knowledge such as explicit and tacit knowledge (Smith 2001). These opportunities also facilitate the construction of shared meaning, which also help to build trust (Hardy, Philips and Lawrence, 1998).

The hazardous environments that Colin works in are much different to the environments Alan works in. Whilst interviewing Colin he tells me that he prefers to work in two's as he likes to stick to a broad plan of action which he discusses with his partner prior to going into the furnace. By sticking to such a plan, Colin says that both people have a high level of awareness of what each person is and should be doing and if anything goes wrong, the other person can be at hand to help.

Colin informed me that he had tried executing such an exercise with three people and said it was a nightmare where each person didn't known what the other two were doing and were frequently bumping into each other.

Goldenweiser, (1916) observes that there is a relationship between an organisation's environment and its culture; however the nature of this relationship is not a simple as they both change at different rates. As a result, some parts of an organisation's environment may affect its culture at various times based on people's behaviours, actions and such a relationship may function in a reciprocal manner.

6.3.2.2 THE VALUE OF SHARING PRACTICAL KNOWLEDGE IS GAUGED THROUGH ITS IMPACT

This core theme is unique to the Large company sub-group and has been chosen as it considers the value of knowledge, a topic which has been identified in a number of different ways in the thematic analysis.

When recalling her experience of implementing a knowledge management programme at Company B2, Elaine noted that both junior and middle management staff were supportive of the programme, however senior management did not see the value and relevance of sharing practical knowledge.

Generally, knowledge management initiatives are utilised with the aim of capturing knowledge in various ways so that it can be used again (Hansen, Nohria and Tierney 1999). Given the innovative nature of the projects delivered by Company B2, it is possible that senior management may not have been able to see how to best capture project data so that it could be re-used to good effect.

De Long and Fahey (2000) note that culture shapes assumptions about knowledge that are important, and because organisations may typically have numerous subcultures, this may lead to miscommunication and conflict as each may place greater importance on different knowledge items. This was evidenced at Company B2 where Elaine had mixed results with discussions forums with different teams.

As the value of knowledge management programmes are generally realised through their impact as noted by Storey and Barnett (2000), this may well also explain why senior management did not buy into the programme as whole. It is noted further from Story and Barnett (2000) that an extremely high proportion of initiatives of approximately 84% fail to have any real impact.

While reviewing Elaine's National Advisory Council for Further Education (NCFE) report, which chronicles her experiences of implementing a knowledge management initiative at Company E2, the company that bought out Company B2, it is noted that individual teams populated their own team Internet site. The knowledge management team would review each team site and transfer important knowledge to the company's central website. This action appeared to reflect that the company treated knowledge like 'assets of the company' that was available to all company personnel. Teece (1998) acknowledges this view and outlines that intangible assets of a company such as technical know-how, reputation, and customer loyalty are key drivers of competitive advantage.

6.3.2.3 PRACTICAL KNOWLEDGE SHARING CULTURE

The core theme of *"Practical Knowledge Sharing Culture"* has been identified in both sub–groups where the anecdotes appeared to be complementary. In the SME sub- group, when reviewing Company G2's website, the capabilities that inform the development of a practical knowledge sharing culture have been observed. In the Large company sub-group, from a number of Elaine's anecdotes it was possible to identify a range of implementation issues such as changes in working practices and supporting systems to realise a practical knowledge sharing culture.

For Case study five, when reviewing company G2's website the following capabilities were identified, which would enable it to develop a practical knowledge sharing culture:

- A broad range of skills have been developed related to the core platform technologies, which are utilised by the automated systems that the Company G2 makes. The skills noted are as follows:
  - 3D Modelling.
  - Programming of PLCs (Programmable Logic Controllers), SCADA, PCs and Robots.
  - Palletising and materials handling systems.
  - Vision system application.
  - Ultrasonic welding application.
- Development of automated systems for a range of product applications, such as telephones, mobile phones, car seats, car batteries and gearboxes. Here it is noted that the range of applications itself is evidence that a practical knowledge sharing culture has been developed at Company G2, as the range of skills cut across a significant number of products that it makes. Danneels (2002) holds the view that product innovation can draw on existing competencies or require new competences a company may not have, thereby providing opportunities to either exploit or explore new competences. As such, Danneels (2002) comments that new product development undertaken in the manner as outlined may serve as a vehicle for organisational renewal and development of new firm competences.

- It is noted that Company G2 collaborates extensively with both its suppliers and customers who both operate within a range of industry sectors. As a result, this would enable Company G2 to become accustomed with the working practices of companies in a broad range of industry sectors.

From the above, it can be seen that Company G2 has developed a wide breadth of experience through collaborating with both customers and suppliers in a number of industry sectors. It can therefore be deducted that the sharing of practical knowledge in such a manner as conducted by Company G2 could be viewed as the development of a shared experience. Such a shared experience is similar to that of 'organisational memory' as proposed by Stein and Zwass (1995).

The above scenario highlights a knowledge sharing process as being finite and requires some form of broader reflective activity, that enables an individual or group of individuals to draw meaning to a new set of circumstances. This broader reflective activity has been highlighted by Endsley (2006) as situation awareness where an awareness of how the knowledge sharing process is bound is established. Situation awareness has been defined by Endsley (2006) as *"the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.*

When considering situation awareness, Endsley (2000, 2006) observes that an individual's ability to identify the most important elements, comprehend their meaning within a given context of practice, and formulate appropriate actions, develops with their level of skill. As the level of complexity in scenarios increases, Jordan, Messner and Becker (2009) note further that the ability to identify specific elements to a context, and analyse differences in alternative plans of action becomes a very important part of daily learning.

When considering Company G2's capabilities to develop a practical knowledge sharing culture, it is anticipated that this has been achieved through shared

values, beliefs and assumptions of how specific environmental elements behave in different contexts.

From Elaine's experience of implementing knowledge management programmes at Companies B2, E2 and F2, the following items have been utilised to realise a practical knowledge sharing culture.

- A knowledge management programme should be supported by senior management who also have a vision of success that they share and motivate employees to share practical knowledge at all levels of an organisation. At Company F2 in her current role, Elaine outlined that from her first day she was being pushed by senior management to implement their knowledge management programme. Chait (1999) highlights top management support as being essential to the success of a knowledge management programme. In addition, it is noted from the same author that a knowledge management programme should also be linked to a company's business strategy so it is not seen as a separate activity.
- The systems used to promote the sharing of practical knowledge should meet the requirements of company personnel. Such systems should be integral to the working practices of an organisation.
- The outcomes realised by sharing practical knowledge should be embedded into a company and in doing so this would demonstrate the value in sharing knowledge and build confidence in a company's knowledge management programme and the associated systems used.

  The above two items are based on Elaine's experience of implementing a lessons learned system at Company B2. Research conducted by Holsapple and Joshi (2004) have acknowledged that the effective implementation of knowledge management programmes should be realised through integrating the systems used and embedding the outcomes from such an initiative.
- An appropriate number of individuals should be appointed who can drive or champion a knowledge management programme. This is based on the experience of Elaine at company G2 who only appointed one person,

Company E2 CEO as the Chief Knowledge Officer, which she thought fell short of the mark. Havens and Knapp (1999) outline that a number of champions should be appointed to drive the implementation of a knowledge management programme.

- There should be a change from a 'silo' working mentality to a cross functional or horizontal team working approach where people across different organisational functions can work together. This cultural shift was promoted by Elaine whilst working at company G2 and is chronicled in her NCFE report. Implementation of cross functional working has been investigated by Lockwood, Smith and McARA-McWilliam (2012) who outline the cultural challenges enhancing and embedding innovative capability in SMEs.

Evidence was also observed where the above principles were adopted to promote the sharing of more tacit forms of practical knowledge. For example when championing the knowledge management programme at Company B2, Elaine arranged to get some of the company's technology development engineers to discuss project ideas with the technicians. This activity also helped to promote cross-functional working. Elaine's efforts to promote ways of sharing tacit practical knowledge have also been evidenced in her current role at Company F2, where she briefly told me that she encouraged the sales staff to turn their smartphone camera's on themselves and talk about their experience after having a meeting with clients. Example topics included; how the client liked to be greeted and how receptive they were and if they took notes during their meeting.

It is acknowledged here that the items supplied by Elaine through her experiences are not a comprehensive treatment; these are issues that are memorable to her as evidenced through her anecdotes.

6.4 RESEARCH QUESTION TWO (RQ2)

In this sub-section anecdotes from the SME and Large company sub-groups both relating to the core theme of *"Informal Learning"* and *"Standardisation as a mechanism for Informal Learning"* are compared and contrasted with the

literature. Anecdotes related to ancillary core themes are then compared and contrasted in a similar manner.

6.4.1 CORE THEME: INFORMAL LEARNING

One commonality that is evident in both the SME and Large company sub-groups is that the processes used to learn on the job were identified.

In case study six, within the anecdotes of Frank, he describes how he teaches a new Materials Requirement Planning (MRP) system to a colleague at Company H2. The learning processes were characterised by a reciprocal exchange of practical knowledge, with reflective checks were periodically used, to ensure how well Frank and the learner's understanding were aligned.

In Elaine's anecdote, when recalling her experiences working at Company B2, she refers to an event where discussions between technology development engineers and technicians took place. The learning experiences within both anecdotes are similar in that two people are learning together and there also appears to be mutual exchange of practical knowledge.

The type of reflection utilised in each case however appears to be different. For example, the 'stupid questions' used or posed by the technicians act like reflective checks and get the engineers to think more deeply about their actions. In this respect the technology development engineers appear to use a form of double loop learning (Argyris and Schön 1974), where they would reflect on the focus of their work with a view to possibly changing the scope of it with a view to produce better results. In Frank's anecdote however the form of reflection used appears to be similar to that as proposed by Shön's (1983, 1987) reflection on action. At this point Frank appears to ask the learner about their "espoused theory" having observed their "theories in use" (Argyris and Schön 1974).

Colin's learning process used in real-life modelling is similar to the aforementioned processes where reference points are used to break up and reflect on the experience, however Colin's process is slightly more advanced in that the 80/20 or Pareto rule is used to apportion some of the efficiency to parts

of the setup used. Colin does this invariably when developing technologies that are novel and no known methods exist to calculate the efficiencies. Colin may then compare each calculation to the results produced for similar best in class technologies. The Pareto principle is typically used in conjunction with various quality tools and techniques (e.g. Statistical Process Control or SPC) to identify the main sources of variability in organisational processes (e.g. Does, Trip and Schippers 1997). In a similar manner to Pareto, benchmarking and self-assessment tools have been used in the area of quality engineering to identify best practice and areas for improvement in working practices (Voss, Chiesa and Coughlan 1994).

Alan's anecdote differs from those of Elaine and Frank in that it primarily describes the way he learns about a partner. This is typically called asymmetric learning by Inkpen and Currall (2004). Through observation and interviewing it appeared that Alan learned about Company A by studying their working practices and developing his knowledge of their products that would enable him to design equipment for them. The learning process adopted by Alan was characterised by a series of actions, where he developed an understanding of the cause and effect relationships between the two domains with the help of Company A.

One barrier that frequently impeded Alan's progress was the lack of availability of product information. As Company A is a first tier automotive supplier to a number of OEMs, it invariably found itself in the dark on varying aspects of product specifications. This gives rise to a situation where it is difficult to discern the cause and effects of parts to which no information is available. Researchers refer to this scenario as casual ambiguity, where Szulanski, Cappetta and Jensen (2004) observe that it has a moderating effect on the sharing of knowledge. That is, as the level of casual ambiguity increases, the trustworthiness of the source reduces. In Case study one however casual ambiguity did not have the same impact on Alan, who invariably had other work to occupy him while he was waiting for clarity on some aspects of a project.

When learning about a partner, Inkpen and Currall (2004) outline that this form of learning may reduce the need for formal project controls. In the anecdotes of

Alan, this proposition was observed where for example Alan informed me that Company A did not check his drawings. The current practice is in contrast to the early days when Alan first started working with Company A, when every drawing was checked before it was issued.

When learning is undertaken by one partner (e.g. through knowledge acquisition), Inkpen and Currall (2004) outline that this will result in a shift in bargaining power, reduce trust and potentially lead to formal project controls being utilised. A shift in bargaining power between Company A and Alan was not evidenced in the anecdotes of Alan.

It is however noted from Alan's experiences that learning about a partner was found by him to be quite stressful, where he found it difficult to understand the partners working practices and products that would enable him to do his job effectively.

Unique to the Large company sub-group was the personal learning experiences of Colin and Elaine which resulted in their own personal views being changed. For Colin, this related to the realisation that he was more interested in the combustion side of energy. When implementing lessons learned systems at Company B2, Elaine noted that lessons learned needed to be captured in a different manner where the systems used needed to be more integral to a company's operations. Both experiences appear to be similar in that they use a personal form of reflection similar to that of reflexivity (Luhmann 1995), where people's values and beliefs are challenged and changed.

6.4.2 CORE THEME: STANDARDISATION AS A MECHANISM FOR INFORMAL LEARNING

Two anecdotes have been identified in the Large company sub-group, which consider the different ways opportunities to learn on-the-job are identified. For example in an anecdote given by Elaine, she describes how she gets each team member to create a team site and while doing this they were asked to chronicle their actions in a blog, which would be shared with other team members and feedback would be received. In doing this it is noted that informal learning is

purposeful and systematic. Elaine also informed me that she would get newcomers to read the blogs that were generated, which would provide them with accurate knowledge on how to do their work. This is very similar to the learning behaviours of knowledge workers in knowledge intensive industries as observed by Milligan Littlejohn and Margaryan (2014) who self-regulated their learning in personal learning networks using software tools like Twitter and blogs. When using such tools to consume and develop new knowledge, the authors outline that blogging were used by learners to publicly share self-reflective thoughts.

In Derek's anecdote, where working practices are standardised, the opportunities to learn occur when residual or non-standard knowledge is identified. While in Derek's anecdote for companies in the defence sector this is described as generally being undesirable, companies that have strategic operational programmes promoting continuous improvement tend to look upon such opportunities in a positive manner or "strength orientation" (Akao 2004). Such companies in the automotive sector for example may have quality systems in place that specifically identify residual knowledge such as the 5S system (Peterson and Smith 1998), which primarily looks to reduce waste in the workplace.

6.4.3 ANCILLARY CORE THEMES

In this sub-section anecdotes that relate to the ancillary core themes in both the SME and Large company sub-groups are compared and contrasted with the literature.

6.4.3.1 CAPTURING AND SHARING OF TACIT PRACTICAL KNOWLEDGE

One anecdote has been identified within each sub-group that hold specific implications for the sharing of tacit practical knowledge. In the SME sub-group, the anecdote relates to the Core theme of *"Sharing of Tacit practical knowledge".* In the Large company sub-group, the other anecdote relates to the Core theme of *"Capture and Sharing of Tacit practical knowledge".* For the purposes of this analysis both anecdotes will be considered under the theme of *"Capturing and Sharing of Tacit practical knowledge".*

When learning about production planning prior to taking up a new role at Company H2, Frank describes his experience of being shown how to use a production planning system by one of the company's planners. In Frank's anecdote he specifically refers to being shown how to "juggle" the amounts between resources. When using such a method through time, people invariably develop their own approach and as a result this could be regarded as tacit practical knowledge. In observing Ambrosini and Bowman's (2001) levels of tacitness, it is thought that such a method could be shared imperfectly as there may be numerous factors that could influence the planner's juggling method. Some of these factors the planner may not be able to describe accurately as he may not sufficiently understand how they influence the resource levels. In addition to this, the juggling method most likely would have been only known to the planner, as nobody would have specifically asked him how it's done.

In a similar scenario to the previous anecdote, Elaine describes an event she arranged to get the company's technology development engineers and technicians together to share ideas as part of a knowledge management programme at Company B2. As the technicians ask the "stupid questions", Elaine explains that this helps the engineers to talk and reflect on their ideas, which may appear as a "jumbled mess" to others. As the links or connections between ideas may yield tacit practical knowledge, their meaning may only become apparent to the technicians as they ask more questions. This activity appears to be similar to the concept of reflection-beyond-action as proposed by Edwards (2017) where exploration takes place both individually and collectively between both individuals and some form of transformative learning takes place. It is envisaged that a similar scenario is taking place within Frank's anecdote, however due to the type of practical knowledge being shared; it is highly likely that this will be less tacit.

In Elaine's anecdote she describes how the calculations used by engineers may be explicit and universally known, the assumptions and other associated understanding that support such calculations could be described as tacit practical knowledge. In Elaine's example the assumptions used to support specific ideas

developed by the technology development engineers which appear a “jumbled mess”, as the assumptions related to some of their ideas are only clear to them.

There is also an additional layer of complexity where one person is a subject expert in one area and the other person is not. In such circumstances this may require both people to talk in more basic terms. This could be synonymous to knowledge been shared between groups of different disciplines as noted by Postrel (2002).

6.4.3.2 PRACTICAL KNOWLEDGE SHARING MECHANISMS

In the anecdotes of Alan in the SME sub-group and Elaine in the Large company sub-group the core theme of “*Practical Knowledge Sharing Mechanisms”,* has been identified where various key methods are described that facilitate the sharing of practical knowledge.

Whilst observing Alan I noticed that he used a number of mechanisms for sharing practical knowledge, some of which were effective and some are ineffective. One of the most effective mechanisms for sharing practical knowledge used by Alan is word of mouth. This is confirmed by Staplehurst and Ragsdell (2010) who identifies this mechanism as being one of the most popular ways to share knowledge due to its effectiveness.

Word of mouth as a mechanism for sharing practical knowledge serves Alan well, however as the company he works for is a first tier automotive supplier company, he tells me that the requirements of the customer who is an OEM sometimes gets lost in translation, or delayed. Wang and Wei (2007) term this scenario supply chain information visibility, which can be improved by implementing interorganisational governance mechanisms through the sharing of IT systems.

Alan therefore tells me that if at the start of a job he doesn’t have a fully laid out design brief from Company A, which has been talked through, then he may delay the start of a job or do something else. This scenario may invariably result in Alan either over or under engineering a jig design. A similar scenario was

observed a number of times when Alan received hand sketches by e-mail from a number of customers, who he invariably works for at home.

Through his time working for Company A, Alan has learned various acronyms, which are typically used to describe products, services and job functions. While interviewing Alan referring to a number of products it was noted that he used a number of acronyms that were typically used by Company A to describe a product or product assembly. Acronyms therefore provide personnel with short convenient means of describing form and function of an item. Practical knowledge in both its explicit and tacit forms may be attributed personally to an acronym as a person develops a history of using it and invariably share such experiences when they are recalled. Linde (2001) points out that an acronym may provide the opportunity for the narration of parts of institutional memory.

One of the most advanced forms of practical knowledge sharing mechanism used by Alan was the CAD system, where solid models of the equipment were developed for Company A. Whilst observing Alan it was noted that solid models proved particularly useful when conducting design reviews with Company A engineering staff. Quite often such an event would take place where all the staff concerned would look at a model while discussing it. A particularly useful feature of the software was being able to add movement functionality to specific parts, thereby enabling Alan to show Company A how certain pieces of equipment would move with a product assembly located on it. Such movements may yield useful forms of practical knowledge such as obstructions and interferences (i.e. explicit practice) between a product and jig.

Having drawn a solid model of a jig or fixture, Alan was able to generate 3D PDFs that enabled him to email a pdf document to another person enabling them to review the item in 3D using standard Adobe Acrobat software.

In the Large company sub-group, the discussion forum as described by Elaine in her anecdote is thought to be an effective mechanism for sharing both explicit and tacit practical knowledge. While interviewing Elaine, she tells me that the discussion forums have been implemented at Company F2 and appeared to work

well. Research conducted by Panahi, Watson and Partridge (2013) acknowledge that social media tools such as blogs can be used to attach media files, which may be quite effective in sharing tacit knowledge. However, the authors comment that such systems may not be effective for sharing highly tacit knowledge. In addition, personnel in most cases may not be willing to share information that is personal or provide another company with competitive advantage (Panahi, Watson and Partridge 2013).

Elaine comments that the discussion forums, which is part of software product A has the same functionality as Facebook, where the knowledge management team has added custom reactions for lessons learned, best practice, and improvement opportunity. Therefore if some team member creates a post, other people within the same team or company can respond to it by adding one of the custom reactions and by providing solutions, or other comments. Given that images and video can be added to a post, then discussion forums of this form could facilitate the sharing of practical knowledge as proposed by Guzman (2009) and Ambrosini and Bowman (2001).

The discussion forums at Company F2 have moderators responsible for specific items with the knowledge management team where Elaine works. At this point, the teams affected by any potential changes are identified, and a plan formulated to translate the change or piece of knowledge to Company F2's project management procedures.

At the time of the interview, Elaine informed me that the discussion forum at Company F2 is in its infancy; however she expects staff to become more confident in its use, as a lot of people use social media outside of work.

As the discussion forum is purely being used internally by Company F2 staff, Elaine envisages that the true power of the software would be realised if it was used within their supply chain around the globe, such as Company F2 staff, clients and the client's engineers.

Given the types of company that Elaine and Alan work in, it comes as no surprise that the forms of sharing mechanism used are vastly different. It could however be said that the discussion forums utilised by Elaine at Company F2 appear to have the best potential for sharing both explicit and tacit practical knowledge as defined in this research. In both cases, word-of-mouth was used to good effect, however in Case Study One due to the position of Alan's customer Company A, who is a first tier supplier, this invariably impeded his ability to deliver projects effectively.

6.5 RESEARCH QUESTION THREE (RQ3)

In this sub-section narrative maps along with associated textual data are used to conduct a form of analysis of narratives for each of the four relationship phases as identified in this research.

In total, forty anecdotes were mapped for both sub-groups and from these, eight anecdotes were chosen that were compared and contrasted with the literature using an analysis of narratives. Table 36 presents the anecdotes used from each sub-group that were used to conduct the analysis for Research Question Three.

Case Study Group:	Relationship Phases:			
	Relationship Formation	Relationship Implementation	Relationship Evolution	Relationship Conclusion:
SME	Identification and selection of Supplier Companies by Company H2	Negotiation of annual cost increases by Company H2	Development of a Vacuum Cast Rubber Tyre for Specialist Wheelchair by Company O1	Supplier Forum ran by Company L
Large	Use of Balanced Scorecard to Select Suppliers based on past performance	Contract Negotiation of Engineering Services by Company O1	Supplier Quality Audits conducted by Company O1	Supplier Consortium ran by Company O1 and Company U

Table 36: SME and Large Company sub-group anecdotes used for Research Question Three (RQ3)

For each sub-section, an overview of each anecdote is provided for the SMEs and Large company sub-groups. By inspecting each relative narrative map, characteristic and uncharacteristic trust antecedents and associated practical knowledge shared are compared for each sub-group and then compared with the literature. Based on the work of Mayer, Davis and Schoorman (1995) a characteristic trust antecedent is defined as *"perceived behaviour(s) of the*

trustee that influence the trustor's intension(s) to trust that are found to be characteristic". Similarly an uncharacteristic trust antecedent is defined as *"perceived behaviour(s) of the trustee that influence the trustor's intension(s) to trust that are found to be uncharacteristic".*

General observations are also made on how the trust antecedents observed from the trustor align or match with the trust descendents enacted by the trustee, thereby indicating how well the trustworthiness intensions of the trustor are met.

Note that narrative maps for all relationship phases can be found in Appendix F.

6.5.1 RELATIONSHIP FORMATION

In this sub-section two anecdotes and narrative maps are presented, one from each sub-group for the relationship formation phase. Characteristic and uncharacteristic trust antecedents and associated practical knowledge shared are then compared for each sub-group and to the literature. General observations are then made on how trust was developed between the collaborating partners in each case.

6.5.1.1 SME SUB-GROUP

One anecdote has been identified from Case Study Four, where Frank talks about his experience when working in a previous role at Company H2, a pressing company that did a lot of work for Company J2, a big global company that had a lot of purchasing power.

Frank tells me that Company J2, used to dictate the specification of raw material that should be used for their components; however the purchase of tooling for the work was left to Company H2. Quite a lot of the work for Company J2 was small components that were produced using progression tooling. Frank explains that this type of tooling is a specialist area and requires a lot of development time to prove; as a consequence people were often quite nervous in finding new suppliers.

When identifying a new supplier for progression tooling, Frank outlines that more often than not this would be done through word of mouth, speaking to competitors, or people in the industry and getting recommendations from people who had first-hand experience dealing with such suppliers.

One narrative map for the SME sub-group for the relationship formation phase can be found in Table F1 in Appendix F.

6.5.1.2 LARGE COMPANY SUB-GROUP

In one anecdote from Case Study Four, Derek recalls the balanced scorecard being used by Company O1's purchasing team to assess the performance of a supplier based on the deliveries made over a period of time. Performance criteria used were punctuality, the number of quality defects, and whether there were any concessions used. Derek outlines that the purchasing team at Company O1 would only want to source new work to suppliers that had a really good balanced scorecard.

The perception of using concessions at Company O1, like most engineering companies was not a good one, as it indicated that something had gone wrong. Derek explains that in the defence sector, concessions are a nightmare because of the amount of paperwork and justification that had to be done. Through experience, Company O1 had also observed that once a supplier knows that they can get away with using a concession, it can be really difficult to close the door again as they may just assume that they may be able to use them again. The balanced scorecard is therefore used as a way to rank suppliers and measure their improvement.

In outlining the balanced scorecard method, Derek further mentions that it can however have big repercussions in contractual negotiation because it means that Company O1 cannot guarantee what work a supplier will get, because it all depends on how good their ranking is on their balanced scorecard.

Derek further tells me there are times that Company O1 may push components onto a supplier at the last minute in an emergency, when some internal errors

have been made in specifying a product. The supplier may invariably agree to help Company O1 out so the components can be used and a concession would be raised by Company O1. As a concession was raised for the work, the supplier company would get penalised on it, as it would count against them when being assessed for new work using the balanced scorecard. This may also have an impact on the trust based relationship between the two companies.

Derek explains that from the supplier company's perspective, the fact that they helped Company O1 was not looked upon favourably in the longer term, as the method they used to source work did not take such circumstances in to account.

Reflecting upon the whole experience, Derek comments that this raises an issue as to whether an objective method such as the balanced scorecard for appraising suppliers should be used in isolation, when other items such as their sense of urgency and agility, and willingness to help solve a problem, regardless of who caused the problem are also important.

One narrative map for the Large company sub-group for relationship formation phase can be found in Table F2 in Appendix F.

6.5.1.3 DISCUSSION

Both anecdotes are similar in that they both describe how partners are selected, however Frank's anecdote relates to the selection of new partners with specialist expertise, where he relies on other companies for word-of-mouth recommendations about their reputation. In Derek's anecdote on the other hand, he recalls how the balanced scorecard is used to rank supplier companies with whom his company already has a working relationship, and therefore has first-hand experience of their capabilities. When investigating networking dyads Larson (1992) noted how both personal and company reputation reduces uncertainty and facilitates collaboration between partnering companies. Similarly, Hong and Wang (2009) observed how partners may be identified through positive word-of-mouth recommendations from favourable company reputations. Such a favourable reputation may be promoted within a company, and become an accepted view, or generalised morality (Granovetter 1985). Such an accepted

view may also be promoted through institutional trust (Zucker 1986), which may be developed either within a company or between partnering companies.

For both sub-groups as presented in Tables F1 and F2, four knowledge sharing cycles were observed where trustors appeared to share explicit procedural knowledge or explicit practice, based primarily on the trust antecedent of ability. This finding is supported by McAllister (1985) who outlines that partners may be identified and selected on the basis of their ability, or competence which is termed cognitive trust. In addition, it is noted further that cognitive trust is evident in phase one of the taxonomies proposed by Nielsen (2004) and Shilke and Cook (2013).

For the SME sub-group for example, in knowledge sharing cycle 1 in Table F1 where the trust antecedents of ability, reliability and integrity were observed when Company J2 shared explicit practice with Company H2. Ability is chosen by Company J2 when asking Company H2 to demonstrate their ability to source a competent toolmaker and reliability in being able to produce and supply Company J2 with dimensionally accurate components. It is noted that both ability and reliability are reported by for example Mayer and Davis (1999) and Chow and Holden (1997), who identified these are common trust antecedents when developing trust.

Integrity is chosen as this relates to where Company J2 dictates what material it wants Company H2 to use. The definition of integrity used here is the same as that defined by Mayer, Davis and Schoorman (1995) who define integrity as *"the Trustor's perception that the Trustee will adhere to a set of principles that the Trustor finds acceptable".*

One uncharacteristic trust antecedent of empathy in knowledge sharing cycle 2 in Table F2 had been observed within the anecdote of the Large company sub-group where Company O1 shared explicit practice with a supplier company. Empathy was chosen as Company O1 wanted the supplier company to understand how they managed to incorrectly specify a component and subsequently asked a supplier company to make non-standard components for

which a concession would be raised. It should be noted that empathy was observed with two other trust antecedents of ability and integrity. Ability was chosen because Company O1 wanted the supplier to be able to meet the stated product specification and integrity was chosen because the supplier was required to demonstrate that it adhered to Company O1's quality procedures when submitting non-standard products.

When comparing the trust antecedents with trust descendents, in both cases it can be seen that trustees appear to signal or enact the trustworthiness intensions of the trustors. In the Large company sub-group narrative map in knowledge sharing cycle 2 (Table F2) it is noted that when Company O1 asked its supplier companies to produce non-standard components it is asking its partner to demonstrate integrity. This issue is contentious as the supplier is meeting the requirements of the person who requested the components, however producing non-standard parts is generally considered to be bad practice, as a result this could be considered as being of low integrity. By conforming to the requirements of Company O1 in producing the non-standard components, however it is thought that Company J2 enacted integrity.

6.5.2 RELATIONSHIP IMPLEMENTATION

In this sub-section two anecdotes and narrative maps are presented, one from each sub-group for the relationship implementation phase. Characteristic and uncharacteristic trust antecedents and associated practical knowledge shared are then compared for each sub-group and then the literature. General observations are made on how well trust is developed between the collaborating partners in each case.

6.5.2.1 SME SUB-GROUP

One anecdote from Case Study Six has been chosen which relates to Frank's experience in a previous role working at Company H2, where he was involved in negotiating annual cost increases for subcontracted work with a customer in the Automotive sector.

The meetings to conduct the negotiations were attended by Frank, his Managing Director and the customer's main Buyer and Operations Manager at their site. They would sit down and look at the specifics such as the numbers related to the overheads, raw material costs, and labour costs.

Frank would argue a case for why they needed to put the prices up and the customer would try and minimise that as much as possible. But Frank emphasises that this was a very involving exercise or as he calls it "toing and froing" because Company H2 also had to look at things like logistics and other services that they provided such as kanban deliveries.

Frank recalls one time when the Operations Manager initially said that they weren't accepting any of Company H2's proposals, unless they demonstrated some cost savings that would benefit them. As a result, Company H2 went away and identified some cost savings and other associated benefits that would make increases more palatable to the customer. The proposed cost increases with associated benefits were then presented to the customer who then agreed to the proposals.

Whilst conducting the interview, I asked who paid for the tooling and, if it was paid by Company H2, was the cost reflected in the price of the components. Having worked in this sector, I am aware that when the customer buys the tooling, this can cause conflicts between both partners, on how maintenance costs are reflected in the price of a component.

In the case of the supplier in question Frank informed me that Company H2 charged the customer for 70% the cost of the tooling and the remainder was paid by Company H2 due to ongoing work such as maintenance that was being done on the tools. The products were therefore costed to reflect these arrangements.

I asked Frank what happens if the customer wanted to move suppliers. Frank acknowledges that such scenarios can get quite complex, however in the event of the customer wanting to change suppliers, Company H2 would insist on being paid the remaining 30% for the tooling prior to releasing them. In the time he

worked for Company H2 this type of situation happened very rarely and after ten to fifteen years the tooling is more or less forgotten about.

One narrative map for the SME sub-group for relationship implementation phase can be found in Table F3 in Appendix F.

6.5.2.2 LARGE COMPANY SUB-GROUP

One anecdote has been chosen from Case Study Four where Derek recalls his experience at Company O1 negotiating a contract for engineering services with Company S2.

While working in a previous role at Company O1, Derek found that the company's engineering workload vastly outweighed the number of engineers it had to fulfil it. Company O1 therefore decided to review the company's engineering processes to see if it could utilise its engineering resource more effectively.

Derek outlines that the analysis revealed that engineers who had the capability of doing design and experimentation work were actually doing standard tasks. Based on the findings of the analysis, Company O1 therefore decided to extract the standard tasks and outsource them to an onsite engineering services provider, Company S2.

When negotiating the contract with the Company S2, Derek recalled that the company wanted to know how many people they required, in response to this Derek outlined that they needed to have the precise amount of resource available on site at any given time. This was problematic for both parties as they didn't know what the optimal level of resource was. Realising this, Company S2 wanted a guarantee that they would be paid for all the time that they had people on site. At this point Derek pointed out to me that his company would only pay for the work that needed doing and it was up to the Company S2 to determine how many people were needed on site at any given time. When considering this arrangement, both companies agreed that as the model matured, Company O1 would pay by deliverable. In doing so, it was up to the Company S2 to make sure

how responsive they needed to be, to do the tasks in the time Company O1 needed them to be done.

In demonstrating his point, Derek provides an example to process non-destructive testing data and producing a report, at around £30. Therefore, Company O1 would pay for the service at £30, however if the service provider through time gets better at delivering the service, Derek explains that he would not be bothered and would still pay £30 for the service.

While delivering the service, Derek explained that Company S2 seemed to think that if they got really slick at delivering services, Company O1 would refuse to pay the agreed price. Derek explained to the other company that they were paying much less than it would cost for a Company O1 engineer to do it. As a result, they did not intend on base lining the price and that any improvement made was money in the service provider's pocket. While reflecting on this, Derek told me that it was much harder than he expected to get the other company to get on-board with this arrangement.

Whilst interviewing Derek, I asked how long it took to conduct this exercise. Derek responded that it took around six months to develop a full service catalogue running with standard deliverables, prices and lead times. Derek commented that the service catalogue improved housekeeping behaviours within Company O1, by getting personnel to have components available for processing, which was seen as being beneficial by everybody.

One narrative map for the Large company sub-group for relationship implementation phase can be found in Table F4 in Appendix F.

6.5.2.3 DISCUSSION

Both anecdotes appear to describe negotiations as being asymmetric in nature (Blomqvist 1999), where the larger companies leverage their power in collaborations. It is noted by Blomqvist, Hurmelinna, and Seppänen (2005) that successful asymmetric collaborations require both trust and contracts and this certainly appears to be evident in both anecdotes. For the SME sub-group, the

customer appears willing to accept Frank's annual costs if they come up with some cost savings that will benefit them. In Derek's anecdote, Company O1 appear to demonstrate flexibility and even allow Company S2 some time to determine the minimum level of resource so that the services could be charged as separate deliverables. This arrangement agrees with Woolthius, Hillebrand and Nooteboom, (2005) who noted that contracts and trust should complement one another for successful asymmetric collaborations to be successful.

For both sub-groups as presented in Tables F3 and F4 sixteen knowledge sharing cycles have been observed where trustors appear to share explicit practice based primarily on the characteristic trust antecedent of judgment.

Trust researchers such as Smith and Barclay (1997) have identified judgment as a common trust antecedent used by collaborating partners. Judgment is however also a key decision making skill utilised in calculus trust, where trust is viewed as an economic calculation whose value is determined by the outcomes resulting from creating and sustaining a relationship relative to the costs of maintaining and in some cases ending it (Lewicki and Bunker 1996). This form of trust is almost certainly evidenced in Frank's anecdote where the customer required Company H2 to produce savings prior to their annual costs being approved. Calculus trust also appears to be evident in Derek's anecdote where the service provider was required to determine a minimum level of resource so that the services could be charged per deliverable. Given the nature of the business model developed between the two partners it is envisaged that this may change in time to cognitive trust where partners trust each other to keep their word and develop the ability to accurately predict how each other will behave (Lewicki and Polin 2013).

It should be noted that calculus (deterrence) trust and knowledge, or cognitive based trust are observed in the models and taxonomies outlined by Lewicki and Bunker (1996) and Nielsen (2004) for the same relationship phase.

For the Large company sub-group narrative map, in knowledge sharing cycle 3 (Table F4) the trust antecedents of judgment and honesty were observed when

Company O1 shared explicit practice with Company S2. Judgment has been chosen where Company S2 is asked to judge what resource to put in place to deliver each service effectively. Honesty had been chosen as it is thought that Company S2 may gain the trust of Company O1 on declaring what progress it had made in reducing the time to deliver the services.

Two uncharacteristic trust antecedents, credibility and ability were observed for the Large company sub-group in knowledge sharing cycle 1 (Table F4), where Company O1 shared explicit practice with Company S2. Credibility has been chosen as Company S2 is asked how it would deliver the services areas. Ability has also been chosen as the service provider would be asked to supply good quality personnel to deliver the engineering services effectively. Credibility has been noted by Ganesan (1994) who identifies this as a common trust antecedent as being utilised in collaborative partner relationships.

In the majority of instances, within both narrative maps, it was observed that after one person shared practical knowledge and the other partner shares practical knowledge back. As a consequence, trust descendents were not observed. In exchanges of this nature, trust antecedents in the second sharing cycle appear to match with the trust antecedents of the first. As a result, trust developed in a mutual and reinforcing manner. Mutual trust is characterised by Meyerson, Weick and Kramer (1996) as trust that develops incrementally through measured interactions that are predictable and mutually reinforcing.

In the narrative map for the SME sub-group in knowledge sharing cycles 5 and 8 (Table F3), where trust descendents were observed, these appeared to match the trust antecedents in the same cycle indicating that trust also developed in a mutual and reinforcing manner. It has also been noted that in the narrative map for the Large company sub-group in knowledge sharing cycle 6 (Table F4), Company S2 demonstrated confidence in allocating the ‘right’ amount of resource when delivering the engineering services for Company O1 and reliability in delivering the services in an efficient manner. Confidence and reliability have been noted by Aulakh, Kotabe and Sahay (1996) and Smith and Barclay (1997)

as being common trust antecedents that are utilised by participants in their research.

6.5.3 RELATIONSHIP EVOLUTION

In this sub-section two anecdotes and narrative maps are presented, one from each sub-group for the relationship evolution phase. Characteristic and uncharacteristic trust antecedents and associated practical knowledge shared are then compared for each sub-group and then with the literature. General observations are then made on how well trust was developed between collaborating partners in each case study.

6.5.3.1 SME SUB-GROUP

The anecdote for the SME sub-group draws on the experiences of Brian from Case Study Two, who recalls his time working at Company O1 when developing a tyre for a specialist wheelchair for a number of customers.

When working at Company O1, Brian recalls a wheelchair project that required the help of another company to make a special tyre. Brian and his colleagues were not sure how it could be done and therefore it was experimental work.

Given the nature of the job, Brian considered a number of companies but decided to approach a local rapid prototyping (RP) Company who he had experience of working with in the past.

Brian e-mailed the RP Company copies of the drawing files and asked the company for a quote. He then decided to follow-up his e-mail with a telephone call to describe the job over the phone. Specifically recalling the time when he phoned the RP Company, Brian admits to me that he struggled to describe what he wanted as he had in his mind that he wanted the tyre to be vacuum cast in one continual lump.

After having a number of calls with the RP Company, Brian decided to go to the company in person and take along the motor that was being used to drive the axle and hub upon which the tyre would be attached. By taking the items along

Brian hoped that he would get the benefit of the RP Company's manufacturing know how to solve his dilemma.

At the meeting, Brian explained to the company that he wanted to vacuum cast the tyre and he showed them the motor that would be used. Upon examining the motor, the RP Company explained to Brian that the tyre could possibly be cast; however the position of the motor would be close to the die that would be used to cast the tyre.

When explaining how the die would be positioned and more details of how the vacuum cast process worked, it became evident to Brian that the die itself would be placed in a vacuum. Brian openly admitted to the RP Company that while he was aware that the vacuum cast process was done under a vacuum, he hadn't realised that the die was also put under a vacuum.

After explaining about the positioning of the die, one member of the RP Company also explained that there may be a risk of some of the silicone getting sucked into the internals of the motor, which was something else that Brian hadn't taken on-board. In response to this, Brian thought that they could get around this by using a false barrier by placing Clingfilm, which would form a seal to protect the relevant areas while the vacuum cast process was taking place. Brian recalled that he had done this on a project in the past, where the method appeared to work. Upon explaining the barrier method to the RP Company, Brian informed me that they were not keen on adopting the method.

Another issue uncovered by the RP Company was that the die would have to be slightly larger than expected, resulting in additional cost, which was seen by Brian as being undesirable for building a prototype. In seeking a compromise, both parties agreed it would be best to cast the tyre in a c-shape, which would enable the RP Company to reduce the size of the die cavity leaving a gap between the die and motor and cast the tyre in the position that Brian wanted.

Brian then went away and then redesigned the geometry of the tyre to reflect what both parties had discussed.

Two narrative maps for the SME sub-group for Relationship Evolution Phase can be found in Tables F5 and F6 in Appendix F.

6.5.3.2 LARGE COMPANY SUB-GROUP

One anecdote from Derek has been chosen, where he recalls an experience at Company O1 of managing a team of quality engineers who used to conduct inspections at supplier company sites.

Company O1 had a team of quality engineers covering the full range of products that they made and occasionally the engineers would carry out inspections of various supplier company working practices to assess their capability, which Derek says told him how much he could trust them.

While interviewing Derek he tells me that it was one of his tasks to schedule the engineers by triangulating geographically between the technologies involved, location of Company O1, the supplier's factory location and pick the engineer most appropriate for the supplier.

Derek tells me that it took him 12 months to get really good at scheduling the engineers because he realised initially that he tended to send the same engineer to the same place because they knew the component and the supplier. Over a period of time however, Derek noticed that the approach created a familiarity that creates 'blind-spots' in the supplier's surveillance regimes.

I ask Derek to qualify what he means by a 'blind spot'. He tells me that this is where an engineer may assume too much about a supplier, where for example an engineer may see a supplier do something once and if it was okay, so the engineer may not bother checking the task again the next time because they may think that the supplier will do it again. To stop this familiarity developing, Derek informs that he kept 'shuffling the pack', to make sure that a new engineer comes along who will not take things for granted and who will really dig under the surface of what a supplier is doing.

Derek reminds me that his engineers were not paid to trust a supplier; they were in fact paid to validate every aspect of what a supplier does. But he concedes that it's hard for the engineers because they build up a personal rapport with the people in the supplier company.

When first starting the role in the team at Company O1, Derek thought the best way to learn was to go around and see the suppliers and look at the equipment they were providing. Derek refers to a specific example, of one supplier company who had a pump and valve on a piece of equipment that was hydrostatically pressure tested, where water is pumped through a system at pressure to see if the tester can get the valve to break.

Derek explains that when he first witnessed the test, he was looking at the test rig and realised that the supplier would not be able to evacuate all of the air out of the component before they were testing it with water.

Derek points out further that as air compresses, if it fails with compressed air in it at pressure there would be a massive release of energy and that could explode, and potentially kill somebody. However, when a test is done with water because it is not compressible, there may be a slight jolt when a component fails. Therefore uncovering or exposing that issue was something that only Derek was able to do with fresh eyes. Both the supplier and Company O1's quality engineers had just taken it for granted and it had not occurred to them that it would be an issue.

I asked Derek if the supplier modified their set-up after the issue was identified. To his best knowledge when he last observed the test being done he noticed that none of the equipment had been modified and when conducting the test itself the supplier managed to demonstrate the test safely. At this point, Derek was keen to point out that he felt the supplier tried to pacify him and this was found to be one of a number of root cause countermeasures that the company did not have in place, which they were investigating at the time.

Two narrative maps for the Large company sub-group for Relationship Evolution Phase can be found in Tables F7 and F8 in Appendix F.

6.5.3.3 DISCUSSION

The anecdotes chosen for this relationship phase are vastly different where Brian's anecdote recalls his experience of developing a rubber tyre and Derek describes the inspection activities of quality engineers at supplier company sites. Both short stories however, demonstrate the highly tacit and situated nature of informal learning. This finding is supported by researchers who generally refer to informal learning as being tacit, highly contextual and therefore requires making knowledge explicit and codifying it (Wenger 1998; Eraut 2004a). Informal learning has also been described by Eraut (2004a) as being implicit, unintended, opportunistic, unstructured, and integral to what personnel do in their day-to-day activities and therefore takes on many forms.

In the narrative map for the SME sub-group, seven knowledge sharing cycles were observed, while six were observed for the Large company sub-group.

For both sub-groups, explicit practice appeared to be the most common form of practical knowledge shared between partners, however no characteristic trust antecedents were observed. That is, there were no commonalities between the ways in which companies determined the trustworthiness of their partners.

For the SME sub-group, knowledge related to explicit practice was mainly shared between partners, where trustors shared practical knowledge either based on credibility and ability or empathy and judgement.

For example, in the SME sub-group narrative map in Table F5 for knowledge sharing cycle 1, the trust antecedents of credibility and ability were observed when Brian shared explicit practice with the RP Company. Credibility was chosen as Brian was seeking credible ideas and ability was chosen as Brian wanted the RP Company to provide potential solutions by using their manufacturing know-how.

For knowledge sharing cycle 6 in Table F5 the trust antecedents of empathy and judgement were observed when the RP Company shared explicit practice with Brian for the SME sub-group. Empathy was chosen as the RP Company stressed their concern of silicone getting in the internals of the motor and therefore wanted to share their understanding of this. Judgement was chosen as the RP Company wanted Brian to use his experience to modify the geometry of the tyre in a way that enable them to vacuum cast the tyre in place.

In the Large company sub-group narrative map (Table F7) in knowledge sharing cycle 1, the trust antecedents of ability, honesty and integrity were observed when the quality engineer shared explicit procedural knowledge with the supplier company. The trust antecedent of ability was chosen as the quality engineer, when carrying out an inspection, wanted the supplier company to demonstrate a safety procedure that was able to meet the relevant safety standards. Integrity was chosen in that the procedure used was acceptable to Company O1 and honesty in that no short cuts were taken (e.g. cheaper products or materials), which could jeopardise the safety of other personnel.

The trust antecedents of honesty, integrity and judgement were observed in knowledge sharing cycle 2 in the Large company sub-group narrative map (Table F7) when the supplier company shared explicit practice with the quality engineer. These trust antecedents complement those shared by the quality engineer, where the supplier demonstrated the test and sought confirmation that it had been done to the quality engineer's expectations. It is noted here that the responses from the quality engineer were not discussed in the interview and therefore not mapped.

Two instances have been observed where empathy appeared to facilitate the sharing of tacit procedural knowledge in the SME sub-group and tacit practice in the Large company sub-group. It should be noted that tacit procedural knowledge and tacit practice have been considered to be uncharacteristic in this analysis. Flavian, Guinaliu and Pau (2018) have recognised empathy as being an antecedent of trust when studying trust behaviours of team leaders in a virtual

environment. The importance of empathy has also been observed by Mayer, Caruso and Salovey (1999) and Goleman (2004) when studying emotional intelligence in personal and working relationships. When studying knowledge management in service organisations, Othman and Abdullah (2012) propose a number of theoretical propositions of how emotional intelligence facilitates the sharing of tacit knowledge, where emotional intelligence can be realised through empathy, cooperation, collaborative efforts in problem solving, and conflict avoidance. The link between empathy and sharing of tacit knowledge can therefore be seen, however the complexity of it is also evident.

For the SME sub-group, knowledge sharing cycle 5 in the narrative map (Table F5) for example, shows that the trustworthiness intensions of Brian were based on empathy and ability, when sharing tacit procedural knowledge. In doing so, Brian admitted that he did not know that the die would be placed in a vacuum and wanted further details about the process. Empathy was chosen because Brian wanted to inform the other company of his understanding of the vacuum casting process and ability was chosen as Brian wanted the RP Company to use their know-how to help him come up with a solution. This knowledge had been classified as tacit procedural knowledge as this view at the time was one held solely by Brian and possibly not known to other people. This view of tacit knowledge is in line with that proposed by Ambrosini and Bowman (2001), which could be articulated if the right questions were asked.

Knowledge sharing cycle 5 in the Large company sub-group narrative map (Table F7) shows that the trust antecedents of honesty, empathy and integrity were observed when Derek shared tacit practice with the supplier company. Honesty was chosen as Derek wanted to know if the supplier had noticed that the air could not be evacuated from the test rig. Empathy was chosen as Derek wanted to share his understanding of the damage the air could make and he wanted them to confirm that they understood this. Integrity was chosen as Derek wanted to know the process that the supplier used for the test.

For the SME sub-group, trust appeared to be developed in a mutual and reinforcing manner, where the trustworthiness intensions of the trustor appeared

to be enacted by the trustees in each case. In addition, empathy was exercised in most sharing cycles, where the RP Company looked to share their views and developed a shared understanding on specific items with Brian.

For the Large company sub-group as observed in Table F7, the trust antecedents demonstrated by the supplier companies appear to complement the trust antecedents enacted by the quality engineers who were conducting inspections and requesting equipment demonstrations from each supplier company.

One noticeable exception was observed where trust was not developed in knowledge sharing cycle 6 in Table F8 for the Large company sub-group with low ability and integrity being observed when a supplier tried to demonstrate safely a hydrostatic pump test set-up, which Derek had observed to be dangerous.

6.5.4 RELATIONSHIP CONCLUSION

In this sub-section two anecdotes and narrative maps are presented, one from each sub-group for the relationship conclusion phase. Characteristic and uncharacteristic trust antecedents and associated practical knowledge shared are then compared for each sub-group and then compared with the literature. General observations are then made on how well trust had been developed between the collaborating companies analysed in each sub-group.

6.5.4.1 SME SUB-GROUP

One of Derek's anecdotes has been chosen for the SME sub-group where he recalls a forum set up by Company L to review the lessons learned after developing a piece of equipment Company L Product A with other collaborating companies. Brian tells me that oil and gas is a funny sector to work in as he recalls his memories of the forum.

Brian explains that he did not attend the forum; however he was part of the team that developed the equipment that was being reviewed by the collaborating partners. One of the senior engineers within Brian's team attended the forum, who told him about the event due to his involvement in the project.

Brian recalls that Company L had developed a piece of equipment Company L Product A, that dug trenches in the sea in which cables were placed for offshore wind turbines. This equipment was used by a number of collaborating companies who were installing the wind turbines and Brian outlines that the forum was set-up by Company L to understand the problems they experienced when trenching cables between turbines.

Brian outlines that some of the collaborating companies attending the event were Companies O2, P2, Q2 and R2, who he describes as 'big end players' that made towers, ploughs and other related equipment.

While at the forum, the chair of the event asked the companies what feedback they had, to which the partners said that they did not have any problems. Every job was no problem to them and the equipment was perfect. But equally, Brian was informed that nobody was willing to step forward and describe any of the problems that they had experienced and therefore nobody was willing to give Company L that information.

After the forum had ended, the senior engineer from Company L had thought that the event was a waste of time because their company were looking to identify the difficulties that the partners had in using the equipment and he got the impression that they certainly did not want to 'air any of their dirty laundry' in public.

After explaining what happened at the event, I commented that it was quite interesting in that Company L knew that the partners may have had some issues, however none of them were willing to disclose them. Brian outlined that the exercise should have been done on an individual basis rather than as a group. Brian thought that the perception was that if a partner said that they struggled to do, for example, an end termination they might have asked Company L to do it with the machine. In doing this, it was thought that other people in the room would be straight onto their customers informing them that they wouldn't touch them, as they struggled with their end terminations. As result, Brian thought it would be difficult for a company to admit things like this as partners may view their actions in different ways.

One narrative map for the SME sub-group for relationship conclusion phase can be found in Table F9 in Appendix F.

6.5.4.2 LARGE COMPANY SUB-GROUP

One anecdote has been chosen from Case Study Four, where Derek recalls his experience while working at Company O1 of a supplier consortium, which was set up with one of its collaborating partners Company U to identify the root cause of a quality issue in one of their product assemblies called a reactor plant.

Derek tells me that Company O1 designed and manufactured a reactor plant, but outsourced some of it to other companies such as Company U who builds sub-assemblies and buys smaller parts from other supplier companies.

While building product assemblies for Company O1, Company U invariably encounter a quality issue that spans a number of different suppliers. To enable them to identify the root cause of such an issue both Company O1 and Company U would have consortiums of suppliers who would come together and discuss the issue in an open and honest way.

Derek tells me that identifying people to attend the consortium may be problematic as the commercial people in the purchasing and sales departments of supply companies may see attending the event as an admission of guilt, say that they hadn't done anything wrong and therefore be unsure about the idea. But from previous events it had been noted that the people who understood the product were generally far more open and really interested in taking part in the problem solving and didn't get hung up over liability issues. Derek therefore found the consortium initiative to be a far more effective and efficient way of communicating when there are a number of people from different suppliers who may not be all that senior and have a common interest in getting to a solution regardless of whose fault it was.

At the consortium it was explained by Company U1 that they had dry assembled a temperature sensor, tested it and while disassembling it found that they could not get it out again.

Derek describes the temperature sensor, which was designed by Company O1 as being similar to a resistance thermometer, which is about 35cm long and 8mm in diameter and goes to a very thin point. The sensor fits in a pocket in a steel housing that is deep drilled to similar dimensions as the sensor. It is noted here that two suppliers were involved in making this assembly, one for making the sensor and the other for making the housing.

When discussing the specific temperature sensor assembly, it transpired that the supplier who made the sensor housing had a problem drilling it to such a depth to ensure that there was sufficient coaxiality so that the sensor would fit snugly throughout its length. Upon realising this, the supplier noted that Company O1 had not supplied any measurements on the drawing that would allow them to work out how to achieve coaxiality at different points in the hole.

After realising this issue, the supplier contacted Company O1, who told them to try one of the thermometers in and “sort of feel it”, and if it felt okay, then that would be all right. As a result, there was no science to it other than that.

While interviewing Derek, I commented that both Company U and Company O1 must have had a good working relationship with the housing supplier for them to come to the event and talk about the issue in an open and honest manner. Derek responded that at the time, the supplier who made the housing didn’t have much work on and therefore was keen to find a solution to the issue with Company U and O1.

Derek informed me that as no one company other than Company O1 had an overall end-to-end view of the development process it was their responsibility to review the end-to-end process and take on-board the findings of the supplier consortium. In doing this, they then highlighted what the improvement

opportunities were and then obtained agreement from the each suppler from the consortium to enact the solution.

Two narrative maps for the Large company sub-group for the relationship conclusion phase can be found in Tables F10 and F11 in Appendix F.

6.5.4.3 DISCUSSION

In both anecdotes, the main narrative is similar in that collaborating partners are seen to be coming together to discuss a number of issues related to a particular project, however the outcome is very much different. In Brian's anecdote for the SME sub-group, the collaborating partners are not willing to discuss any issues, however in Derek's anecdote for the Large company sub-group; partners appear to be willing and quite open to discuss their problems. In Brian's anecdote, therefore it could be deducted that the partners may not trust each other enough to share the issues they encountered.

The findings of both anecdotes appear to be in line with the trust reflexivity model as formulated by Sankowska and Söderlund (2015). In Brian's anecdote there appears to be low trust and high value of work assignment characterised by low technical reflexivity and high social reflexivity where there is a perception of being exploited. In addition it is noted that the suppliers appear to place a high value on their project experiences and their reluctance to share them may be due to company protocol, or through the company's institutional trust (Zucker 1986).

In Derek's anecdote, all participants appeared to trust each other and acknowledged the importance of their experience in realising a solution at the consortium. In Sankowska and Söderlund's (2015) trust reflexivity model, this scenario would equate to high trust and high value of perceived value of work assignment, which results in the creation and application of new knowledge leading to a deep state of reflection to further understand a situation from a social and technical perspective. According to the trust reflexivity model as proposed by Sankowska and Söderlund (2015), when both forms of reflexivity are exercised this would result in the transfer of tacit knowledge into explicit knowledge (Polyani 1958). This was confirmed by Derek's anecdote where both

explicit and tacit practical knowledge were shared between the partnering companies who attended the consortium.

Inspection of the narrative maps shows that the SME sub-group has two knowledge sharing cycles, while the Large company sub-group has eight knowledge sharing cycles.

For both sub-groups, both explicit procedural knowledge and explicit practice are shared where honesty appeared to be the most common trust antecedent.

For the SME sub-group in knowledge sharing cycle 1 in Table F9, honesty and benevolence were observed when Company L shared explicit procedural knowledge with the supplier companies. Honesty was chosen as the chair of the forum wanted the attendees to be honest when inviting them to provide comments on the lessons learned from their experiences. Benevolence was chosen as the chair wanted the attendees to supply their comments in a friendly manner.

Examination of the narrative maps for the Large company sub-group showed that when explicit procedural knowledge was shared, the most common trust antecedent was ability and when sharing explicit practice the most common trust antecedents were honesty and empathy.

For the Large company sub-group in knowledge sharing cycle 5 (Table F10) the trust antecedents of honesty, empathy and ability were observed when the supplier company shared explicit practice with Company O1. Honesty and ability were chosen as the supplier company wanted an honest opinion from Company O1 on how the task could be achieved. Empathy was chosen as the supplier company wanted Company O1 to understand the difficulty it had in trying to drill the 35cm deep hole and seeking a method of measuring the coaxiality of the hole at different points.

Uncommon or uncharacteristic forms of practical knowledge had been observed in the Large company sub-group where Company O1 shared tacit practice with a

supplier based on empathy and judgement. For example, in knowledge sharing cycle 7 (Table F10) the trust antecedents of empathy and judgment had been observed, when Company O1 had shared tacit practice with the supplier. Empathy and judgment have been chosen because Company O1 tried to share their understanding of how to best drill the hole by inserting a temperature sensor in the hole and seeing if it “felt okay”. This view of tacit knowledge is in line with that proposed by Ambrosini and Bowman (2001), where it could be articulated in an imperfect manner.

Evidence of trust not being developed was observed in knowledge sharing cycle 2, (Table F9) for the SME sub-group where the trust antecedents of benevolence and integrity were observed when the supplier companies shared explicit practice with the Chair of the meeting from Company L. It is at this point when the supplier companies provided feedback that there were no problems experienced and the equipment was perfect. From the perspective of the Chair, the response from the supplier company would be viewed as low integrity as members of Company L thought that some partners experienced problems when developing Product A. As a consequence, it is envisaged that no trust was developed in this anecdote.

For the Large company sub-group, trust appeared to be developed in a mutual way other than in one instance in knowledge sharing cycle 2 (Table F11) where the trust antecedents of honesty and ability were observed when Company O2 shared explicit procedural knowledge with the supplier companies. When asking the supplier companies if they wanted to attend the forum, some of the commercial departments of the supplier companies saw attendance at the forum as an admission of guilt and therefore demonstrating low confidence and integrity. As a consequence, it is anticipated that trust would not be developed in these instances.

6.6 SUMMARY

Chapter Six compared the findings from the cross-case analysis for both sub-groups with that of the literature. The analysis was conducted using the priority core themes identified from the thematic analysis.

For Research Questions One and Two, additional or ancillary core themes were chosen as it was observed that there were a smaller number of additional themes that were important to answering each research question.

A method devised in this research to frame or map textual data called a narrative map was used to analyse participants' experiences related to the four relationship phases investigated in this research. In doing so, it was possible to identify specific combinations of trust antecedents and types of practical knowledge shared and compare these findings with the literature.

CHAPTER SEVEN
CONCLUSION

7.1 INTRODUCTION

This chapter provides an overview of the research design, summary of the findings and details of the main research outcomes based on the research undertaken. Limitations and further work are then presented along with the main contributions provided by this research.

7.2 OVERVIEW OF RESEARCH

The aim of this research was to *"investigate the influence of trust on the sharing of practical knowledge in technology producing SMEs*".

In order to achieve the aforementioned research aim, the following research questions were investigated.

1 What are the main characteristics of a trust based practical knowledge sharing culture within the sample of SMEs and large companies?
2 What are the specific perceptions and experiences of engineering practitioners who adopt trust based strategies for sharing practical knowledge for each collaboration relationship phase?
3 What are the specific perceptions and experiences of engineering practitioners that demonstrate how trust is constructed and how this influences the way practical knowledge is shared for each collaborative relationship phase?

For research questions two and three the study also investigated how trust influenced the development of collaborative relationships, which have been considered as a four-phase process with project development activities that hold significant implications for trust and knowledge sharing from a practice based perspective as follows:

- Relationship Formation:
  Partner identification, selection and initial trust building.
- Relationship Implementation:
  Contract negotiation and development.
- Relationship Evolution:

Informal learning.

- Relationship Conclusion:
  Collection Reflection.

Based on a review of the literature in the main constituent areas of trust, knowledge sharing and collaborative relationships, which considers the aforementioned activities, specific implications with respect to trust and knowledge sharing were identified, which guided the research.

The research design utilised a qualitative research approach with a multiple case-study strategy, where semi-structured interviews and observations were used to collect qualitative data.

Six case studies were conducted, where anecdotes related to participant experiences working in large companies and SMEs were collated. All companies referred to in the participants' anecdotes operate in a broad number of engineering sectors and geographic locations around the UK.

Using the research methodology outlined in Chapter Three, qualitative data was analysed in two sub-groups in Chapters Four and Five. The findings from each sub-group were then compared in Chapter Six for research questions one and two. Finally, anecdotes which describe collaboration activities related to research question three were then analysed using narrative maps.

7.3 SUMMARY OF RESEARCH FINDINGS

In this sub-section a summary of the main findings for Research Questions one to three are outlined.

7.3.1 RESEARCH QUESTION ONE

In both the SME and Large company sub-groups, one similarity identified was the affective nature of organisational cultures described within the anecdotes for this research question. For example when working at Company I, Brian described a family, clan type culture for the SME sub-group when recalling his time working in the design department.

Trust behaviours described by participants in the anecdotes for both sub-groups such as goodwill and benevolence also demonstrated the affective nature of organisational cultures described by participants. For example in the Large company sub-group, goodwill and benevolence appeared to be evident between Elaine and a software vendor she is working with currently at Company F2.

Transparency was also one trust antecedent that was evident in the anecdotes of both sub-groups. For the Large company sub-group, Colin mentioned that transparency was an important behaviour he looked for from a potential collaborative partner. The same behaviour also appeared to be evident in Company I when Brian recalled that he made a mistake to his older colleagues who then outlined the mistakes they had made in the past thereby demonstrating transparency and honesty.

In a number of anecdotes, there are some indications that trust is not initially based on affective trust behaviours. For example in the anecdotes of Elaine for the Large company sub-group, collaborative relationships were based on ability and integrity with a software vendor where their relationship appeared to develop through solving problems together. After being invited to a discussion panel event however she described herself as being endeared towards the software vendor thereby demonstrating that their relationship entered a new phase. For the SME sub-group a similar observation is apparent in the anecdotes of Frank while working at Company G2 he described the negotiation process with a collaborating partner as being effortless. As the company had been working with Company G2 for 25 years it was envisaged that Frank's negotiation experience was a product of many years of successful repeated transactions.

Realisation of the value of a partner's experience also appeared to act as a stimulus for developing a collaborative relationship, particularly when they were developed in an affective manner. For example, in the large sub-group Colin appeared to be interested in the values and beliefs of partners based on their life experiences as he preferred getting to know people on a more personal level. A similar observation was made from the anecdotes of Brian in the SME sub-group

where he appears to value the feedback and wisdom from older colleagues. In both of the aforementioned anecdotes a strong bond or tie appeared to be developed between the partners.

Two instances were observed within the anecdotes of Elaine where the sub-cultures of Company B2 impeded the sharing of practical knowledge and the realisation of its value in other parts of the company. For example, when describing her experience of implementing knowledge management programmes at Company B2, Elaine noted that both junior and middle management were supportive of the programme, however senior management did not see the value and relevance of sharing practical knowledge. Secondly, when implementing discussion forums at Company B2, Elaine recalled that she had mixed results with different teams.

As an organisation's culture is acknowledged as influencing the promotion of knowledge, all three of the above observations appear to indicate that trust plays a key role in realising the value in sharing practical knowledge.

Unique to the large sub-group was the form of trust developed by Colin, which he described as "fundamental trust", primarily based on personal safety considerations due to the hazardous environments in which he works. It is because of the nature of his work that he chooses to develop personal relationships initially in a social setting so he can get to know the partner's personal core values.

In one of Elaine's anecdotes when interviewing software vendors, she describes informally the process used for identifying and selecting trust antecedents or 'filters' as Elaine describes them. When observing the behaviours of an interviewee, Elaine describes the manner in which a presentation was made and how this influenced the selection of the "filters" she used to make a judgment on whether she wanted to work with them.

The environment appeared to be an important influential factor in both sub-groups, where three radically different types of environment were observed and

described by Alan and Colin. All three environments appeared to affect the development of trust and collaborative relationships in different ways.

For the SME sub-group, two different working environments were observed. First was Alan's office at home, which was a converted cupboard, where he appeared to feel quite isolated, where he did not get the chance to talk to people other than by phone or e-mail. Alan's office at home is a stark contrast to the open plan office used by the engineers at Company A, where because of their close proximity they could discuss work related issues and share a joke.

The hazardous environment that Colin often works in with a partner when commissioning scale furnaces, influences how he develops relationships prior to working with them in such an environment. It is however acknowledged that Colin worked in such an environment part of the time, although this development work was described as being a key part of his work.

Observations were made in both sub-groups which provide insight into how a practical knowledge sharing culture can be characterised and some of the main issues encountered to realise such a culture. For example in Case Study Six, when reviewing Company G2's website, it was noted that the company had collaborated with a large number of customers and suppliers in a wide number of industry sectors. From this observation it was deducted that Company G2 as a whole had shared experiences in a variety of ways that would enable it to develop its technological know-how in a comprehensive manner.

The aforementioned observation indicates the knowledge sharing process as being finite, where some broader reflective activity, such as situation awareness enables an individual or group to draw meaning to a new set of circumstances.

When considering Company G2's capabilities as enabling the development of a practical knowledge sharing culture it is suggested that this has been realised through the shared values, beliefs and assumptions of how specific product and or service elements function in different contexts.

Elaine's experiences of implementing knowledge management programmes provide valuable insight in to the working practices that should be implemented to realise a practical knowledge sharing culture. Specific interest was paid to the working practices undertaken to capture more tacit forms of practical knowledge. For example, when working at Company B2 Elaine arranged an event to get some technology development engineers and technicians together to exchange project ideas. Given that some of the engineers were working on particularly complex projects then it was envisaged that discussions would involve the sharing of tacit practical knowledge.

More recently at Company F2, Elaine encouraged sales staff to use their own smartphones to reflect on their experience of a meeting they have had with clients, which provided the opportunity to capture the more tacit elements of the meeting such as the client's receptiveness during specific parts of the meeting.

Key observations made for Research Question One are as follows:

- The cultures described by participants in both sub-groups appeared to be affective in nature, where trust antecedents such as goodwill, benevolence, transparency and honesty appeared to be evident.
- In a smaller number of anecdotes, trust was observed to be based initially on ability and integrity through working together, after which affective behaviours were observed to be developed.
- In both sub-groups the value of partners' experiences grounded in mutual respect acted as a stimulus for developing collaborative relationships. This appears to indicate that trust plays a key role in realising the value in sharing practical knowledge.
- The environment appeared to be an important influential factor where it affected the development of trust in collaborative relationships.
- Through the anecdotes it has been possible to characterise a practical knowledge sharing culture as shared values, beliefs and assumptions of how specific product and or service elements function in different contexts.

7.3.2 RESEARCH QUESTION TWO

For Research Question Two it was possible to characterise the informal learning processes utilised in the anecdotes of Frank, Colin and Alan as follows.

- For the SME sub-group Frank describes how he teaches a colleague how to use a new MRP system, and while doing so, talks of his experience of learning how to teach. The experience is described as informal instruction where Frank shows his colleague some of the system's features, and then the other person performs the same action. This series of actions are then followed by reflective checks, where Frank would ask his colleague to explain their actions to ensure that their understanding was aligned.
- The second informal learning process described by Colin for the Large company sub-group used for developing novel glass furnace technologies, which he calls real-life modelling. The process is similar to that described by Frank in that reference points are used to break up and reflect on the experience; however it is slightly more advanced in that the Pareto rule was applied to apportion efficiencies to the equipment used. As the method was used to develop novel technologies, the efficiency calculations produced would be compared to similar best in class technologies.
- The learning experience described by Alan for the SME sub-group describes how he learns about his larger collaborating partner, Company A's working practices and develops his knowledge of their products. The learning process appeared to be characterised by a series of actions where Alan develops an understanding of the cause and effect relationships between the two domains, which enables him to design equipment. As Company A is a first tier automotive supplier, it invariably found itself uninformed about varying aspects about product specifications. This in turn impeded Alan's ability to progress projects and is commonly referred to as casual ambiguity (Szulanski, Cappetta and Jensen 2004). It was noted that this scenario did not adversely impact on the trust between Alan and Company A.

Unique to the Large company sub-group were the personal learning experiences of Colin and Elaine, which appear to demonstrate a form of personal critical

reflection, which resulted in their own values and beliefs being changed. For example, in one of Colin's anecdotes, while reflecting on his time at university for the first time he realised that he was more interested in the combustion side of energy. For Elaine, while reflecting on her experiences of implementing lessons learned systems, she concluded that the lessons should be captured in a manner that is more integral to a company's daily working practices.

Two anecdotes relating to the Large company sub-group demonstrated how informal learning opportunities can be identified and regulated. In her current role at Company F2, Elaine describes how she gets her team members to create a team site and in doing so chronicle their actions in a blog, which were shared with other team members who would provide feedback. Informal learning conducted in this manner provides the learner with the opportunity to self-regulate their learning, while also providing reflective thoughts that could benefit other people's informal learning.

In Derek's anecdotes, he recalls his experience of working in the defence sector and described how working practices are standardised, through the identification of residual or non-standard knowledge. Derek refers to non-standard knowledge as being generally undesirable, however it is noted that for some companies in for example, the automotive sector having strategic operational programmes that promote continuous improvement is looked upon as an opportunity to learn in a positive manner. This is acknowledged by Derek when recalling his time working at Company C in the automotive sector.

In the anecdotes of Frank and Elaine, two instances were identified where tacit practical knowledge was shared between colleagues within their respective organisations. First, in one of Frank's anecdotes, before taking up a new role at Company H2, he recalls being shown how to use a production planning system and specifically refers to being shown how to 'juggle' the levels of resources. Such knowledge has been viewed as being tacit as the method developed may only be known to the production planner. In addition, it is thought that there may be numerous factors that could influence the resource levels, which may restrict the planner's ability to describe the method accurately.

Second, Elaine recalls her time working at Company B2, when she arranged an event to get some of the company's technology development engineers and technicians together to discuss project work. As the technicians asked the 'stupid questions', this prompted the engineers to talk and reflect on their ideas, which initially appeared as a 'jumbled mess' to the technicians. In addition, it was noted that as the discussion progressed, the assumptions made by the engineers revealed tacit knowledge as the meaning of key ideas were developed between the two people.

Observations regarding the use of practical knowledge sharing mechanisms are noted as follows:

- In general, participants in both sub-groups appeared to use word of mouth communication effectively; however there were a smaller number of instances where this could not be used effectively. For example, in the SME sub-group Alan often found that he may not get access to product information in a timely manner from his customer, a first tier supply company who works for a number of original equipment manufacturers.
- Advanced forms of sharing mechanisms appeared to be used by participants in both sub-groups. For the SME sub-group, this was the CAD system used by Alan, where solid models of jigs and fixtures were developed and proved to be particularly useful when conducting design reviews. During such events it was noted that a model would be discussed while considering the placement of a product assembly upon the equipment and observing noticeable obstructions and interferences.
- For the large sub-group, in a number of anecdotes Elaine described how discussion forums have been used by the companies where she has worked. Of particular interest is the current system, which has been implemented at Company F2, which has similar functionality to Facebook, and is thought to be an effective mechanism for sharing explicit and tacit practical knowledge. As images and video can be added to posts that are created in this software, it is envisaged that discussion forums of this nature could potentially facilitate the sharing of practical knowledge as defined in this research.

- Through the anecdotes of Alan in the SME sub-group, it was observed that Alan had learned various acronyms from working with Company A, which are typically used to describe products, services, job functions and other items. As a result, it noted that acronyms provide personnel with a convenient, short means from which some slang terminology may be created to describe the form and function of an item. When considering this, it is thought that both explicit and tacit practical knowledge may be attributed to an acronym as a person develops a history of using it, which may be shared when recalling related experiences.

Key observations made for Research Question Two are as follows:

- It was possible to characterise the informal learning processes utilised by participants in both sub-groups. For example, the informal learning process of one SME was characterised by learning about its larger collaborating partner's working practices and products and understanding the cause and effect relationships between the two domains.
- One large company was observed to take proactive measures to promote the sharing of tacit practical knowledge. For example an event was arranged to get the company's engineers and technicians to discuss project ideas where the technicians' 'stupid questions' acted as a mechanism to tease out the engineers' assumptions related to key ideas.
- Two advanced forms of practical knowledge sharing mechanisms were observed. For the SME sub-group this was observed to be the CAD system utilised by one participant, which was particularly useful in identifying obstructions between mating parts when conducting design reviews. For the Large company sub-group, discussion forums which have similar functionality to Facebook appeared to have the ability to share both explicit and tacit practical knowledge as defined in this research.

7.3.3 RESEARCH QUESTION THREE

In this sub-section a summary of the main findings for each relationship phase investigated in this research are presented.

1 RELATIONSHIP FORMATION

The anecdotes of Frank and Derek were chosen where both describe the selection of collaborative partners, however in Frank's anecdote; he considers the selection of new partners with specialist expertise in making progression tooling. In Derek's anecdote he recalls how the balanced scorecard is used to rank and select supplier companies, with whom he has previous experience of working with.

For both sub-groups two knowledge sharing cycles were observed where trustors appeared to share explicit procedural knowledge or explicit practice, based primarily on the trust antecedent of ability which is typically related to cognitive trust.

For the SME sub-group for example, in knowledge sharing cycle 1 shown in Table F1, the trust antecedents of ability, reliability and integrity were observed when Company J2 shared explicit practice with Company H2.

One uncharacteristic trust antecedent of empathy in knowledge sharing cycle 2 as shown in Table F2 had been observed within the anecdote of the large sub-group where Company O1 shared explicit practice with a supplier company.

Trust seemed to be developed between the partners in both cases, where it was observed that the trust antecedents and trust descendents appeared to match thereby indicating that the trustees signalled or enacted the trustworthiness intensions of the trustors.

2 RELATIONSHIP IMPLMENTATION

The anecdotes of Frank and Derek had been chosen where both anecdotes appear to describe negotiation activities between two partnering companies where the larger partner appears to leverage their power over the other company. It was however noted that the way in which the power was leveraged was done in different ways. In Frank's anecdote, after presenting their annual costs to their customer who is a large company, a request was made to investigate other cost savings that would benefit them. In Derek's anecdote, when commissioning the

services of Company S2 to deliver a number of engineering services, Derek's company appeared to influence the design and delivery of the business model by asking the Company S2 to determine the optimum level of resource, so that each service could be costed as separate deliverables.

For both sub-groups sixteen knowledge sharing cycles have been observed where trustors appeared to share explicit practice based primarily on the characteristic trust antecedent of judgment, which is commonly used in calculus trust.

In the Large company sub-group narrative map, at knowledge sharing cycle 3 (Table F4) the trust antecedents of judgment and honesty were observed when Company O1 shared explicit practice with Company S2.

Two uncharacteristic trust antecedents, credibility and ability were observed in the Large company sub-group narrative map at knowledge sharing cycle 1 (Table F4), where Company O1 engaged with Company S2 to determine its credibility by asking it how it would deliver the engineering services and determine its ability to deliver the services effectively.

For this relationship phase, trust appeared to be developed between collaborating partners in both sub-groups primarily through the continual exchange of practical knowledge, where the trustors' trustworthiness intensions appeared to be enacted by the trustors in a mutual and reinforcing manner.

3 RELATIONSHIP EVOLUTION

The anecdotes chosen for this relationship phase differ greatly where Brian's anecdote recalls his experience of developing a rubber tyre with a rapid prototyping company and Derek describes the inspection activities of quality engineers at supplier company sites. Both short stories however, demonstrate the highly tacit and situated nature of informal learning, which is confirmed by notable literature such as Wenger (1998) and Eraut (2004a).

For both sub-groups, explicit practice appeared to be the most common form of practical knowledge shared between partners; however there were no commonalities between the ways in which companies determined the trustworthiness of their partners.

In Brian's anecdote for the SME sub-group, explicit practice was mainly shared between partners, where trustors shared practical knowledge either based on credibility and ability or empathy and judgement as shown in Tables F5 and F6.

For the Large company sub-group, reciprocal exchanges of explicit procedural knowledge by the quality engineer, and explicit practice by the supplier, when demonstrating their equipment were observed. When sharing the aforementioned knowledge, the trust antecedents appeared to be mutual, where the quality engineer's trustworthiness intentions were based on ability, honesty and integrity and the supplier reciprocated the aforementioned intensions by enacting honesty, integrity and judgment as shown in Table F7.

Two instances have been observed where empathy appeared to facilitate the sharing of tacit procedural knowledge in the SME sub-group (Table F5) and tacit practice in the Large company sub-group (Table F7). In such scenarios, partners appeared to share their views on specific issues with a view to developing a shared understanding. Empathy has been acknowledged by researchers as being a trust antecedent; however to date no empirical research has been undertaken that outlines how empathy facilitates the sharing of tacit forms of practical knowledge.

For both sub-groups, trust appeared to be developed in a mutual and reinforcing manner, where the trustworthiness intensions of trustors were enacted by the other partners or trustees.

For the SME sub-group, empathy appeared to be enacted in most sharing cycles, where the RP Company shared their perspective and developed an understanding on specific items with Brian.

One noticeable exception was observed where trust was not developed in the Large company sub-group narrative map (Table F8) where low ability and integrity were observed when a supplier tried to safely demonstrate a hydrostatic pump test, which Derek had previously observed to be dangerous.

4 RELATIONSHIP CONCLUSION

In the anecdotes of both sub-groups, the main narrative is similar in that collaborating partners are seen to be coming together to discuss the lessons learned related to a particular project in open forum, however the outcome is very different. In Brian's anecdote for the SME sub-group, after being asked by the chair to provide their views, the collaborating partners were not willing to discuss any issues. However in Derek's anecdote for the Large company sub-group; the partners appeared to be willing and quite open to discuss their problems. It is also observed that a solution was identified as a result of the supplier consortium that was organised by Derek's company. Narrative Maps presenting the anecdotes for both sub-groups can be found in Tables F9 to F11 in Appendix F.

The findings of both anecdotes appear to be in line with the trust reflexivity model as proposed by Sankowska and Söderlund (2015). In Brian's anecdote there appears to be low trust and a high value attributed to project experiences characterised by low technical reflexivity and high social reflexivity where there is a perception of being exploited. In this anecdote it was noted that the suppliers' reluctance to share their experiences may be due to company protocol, or adhering to the company's beliefs through institutional trust.

In Derek's anecdote, all participants appeared to trust each other and acknowledged the importance of their experiences in realising a solution at the consortium, where technical and social reflexivity appeared to be exercised. In Sankowska and Söderlund's (2015) trust reflexivity model, it is outlined that when both forms of reflexivity are exercised this may result in the transfer of tacit knowledge into explicit knowledge (Polyani 1958). This was observed in Derek's anecdote where both explicit and tacit practical knowledge were shared between the partnering companies who attended the consortium.

For both sub-groups, both explicit procedural knowledge and explicit practice were shared where honesty appeared to be the most common trust antecedent.

For the SME sub-group honesty and benevolence were observed when Company L shared explicit procedural knowledge with the supplier companies as shown in Table F9.

For the Large company sub-group when explicit procedural knowledge was shared the most common trust antecedent was ability and when sharing explicit practice the most common trust antecedents were honesty and empathy as shown in Tables F10 and F11.

One uncharacteristic form of practical knowledge had been observed in the Large company sub-group where Company O1 had shared tacit practice with a supplier company based on the trust antecedents of empathy and judgement as shown in Table F10.

Trust appeared to be developed in the case of the Derek's' anecdote for the Large company sub-group where the trust intensions of trustors appeared to be met in most cases. Trust however was not developed in Brian's anecdote for the SME sub-group where the trust antecedents of the chair were not demonstrated by the participating companies at the forum as shown in Table F9. Tables 37 to 39 summarise the findings for Research Question Three.

Key observations for Research Question Three are as follows:

- Characteristic forms of practical knowledge and trust antecedents have been identified which indicate how collaborative relationships develop over the life of a project. Common and unique forms of practical knowledge and trust antecedents evident in the large company and SME sub-groups have also been identified.
- The trust antecedents observed in the relationship formation and implementation phases concur with for example, the trust development models proposed by Nielsen (2004) and Shilke and Cook (2013).

- In the relationship formation phase, explicit procedural and explicit practice appeared to be shared on the basis of ability (cognitive trust). In the relationship implementation phase, explicit practice appeared to be shared on the basis of judgement (calculus trust). Both observations relate to the large company and SME sub-groups.
- For the relationship evolution phase, no specific patterns of trust behaviours were identified, although initial observations show that explicit procedural knowledge appears to be shared on the basis of ability for both company sub-groups. Explicit practice also appears to be shared on the basis of empathy, judgement and honesty for both company sub-groups.
- Empathy appeared to facilitate the sharing of tacit procedural knowledge in the SME sub-group and tacit practice in Large company sub-group in the relationship evolution phase.
- For the relationship conclusion phase, both explicit procedural knowledge and explicit practice appeared to be shared on the basis of honesty for both sub-groups. The anecdotal observations of both sub-groups appear to agree with the conceptual trust reflexivity model proposed by Sankowska and Söderlund (2015). In this relationship phase it was also observed that empathy and judgement appeared to facilitate the sharing of tacit practice.
- On the basis of the observations made, no substantial differences appeared to be observed in the trust behaviours made, and practical knowledge shared in both sub-groups. Power asymmetry however, appeared to be observed where the larger partner seemed to exert their influence when negotiating in the anecdotes for the relationship formation and implementation phases.

Relationship Phase	Sub-Group	Practical Knowledge Shared	Trust Antecedents	Observation (Characteristic, Uncharacteristic)	Knowledge Sharing Cycle No	Narrative Map Table Number
Relationship Formation	Both	Explicit Procedural Knowledge, Explicit Practice	Ability (Cognitive Trust)	Characteristic	-	-
	SME	Explicit Practice	Ability, Reliability, Integrity	Characteristic	1	Table F1
	Large	Explicit Procedural Knowledge	Ability, Confidence	Characteristic	1	Table F2
	Large	Explicit Practice	Ability, Integrity, Empathy	Characteristic Uncharacteristic	2	Table F2
Trust Development	Both	Trustworthiness intensions of the trustor were met by the trustee (i.e. trust descendents matched trust antecedents)				
Relationship Implementation	Both	Explicit Practice	Judgement (Calculus Trust)	Characteristic	-	-
	Large	Explicit Practice	Judgement, Honesty	Characteristic	3	Table F4
	SME	Explicit Practice	Fairness, Judgment	Characteristic	8	Table F3
	Large	Explicit Practice	Credibility, Ability	Uncharacteristic	1	Table F4
Trust Development	Both	Continual sharing of practical knowledge and trustworthiness intensions of the trustor were met by the trustee				

Table 37: Summary of Findings for Research Question Three (Relationship Formation and Implementation Phases)

Note:
Uncharacteristic practical knowledge type and trust antecedents are underlined

Relationship Phase	Sub-Group	Practical Knowledge Shared	Trust Antecedents	Observation (Characteristic, Uncharacteristic)	Knowledge Sharing Cycle No	Narrative Map Table Number
Relationship Evolution	Both	Explicit Practice	None	-	-	-
	SME	Explicit Practice	Ability, Credibility	Characteristic	1	Table F5
	SME	Explicit Practice	Empathy, Judgement	Characteristic	6	Table F5
	Large	Explicit Procedural Knowledge	Ability, Honesty, Integrity	Characteristic	1,3	Table F7
	Large	Explicit Practice	Judgement, Honesty, Integrity	Characteristic	2,4	Table F7
	SME	Tacit Procedural Knowledge	Empathy, Ability	Uncharacteristic	5	Table F5
	Large	Tacit Practice	Empathy, Honesty, Integrity	Uncharacteristic	5	Table F7
	SME	Explicit Practice	Empathy, Honesty, Judgement	Characteristic	4	Table F5
Trust Development	SME	Trustworthiness intensions of the trustor were met by the trustee with Empathy demonstrated by trustee in some cycles				
	Large	Continual sharing of practical knowledge with low Ability and Integrity observed in one instance.				

Table 38: Summary of Findings for *Research Question Three* (Relationship Evolution Phase)

Note:
Uncharacteristic practical knowledge type and trust antecedents are underlined

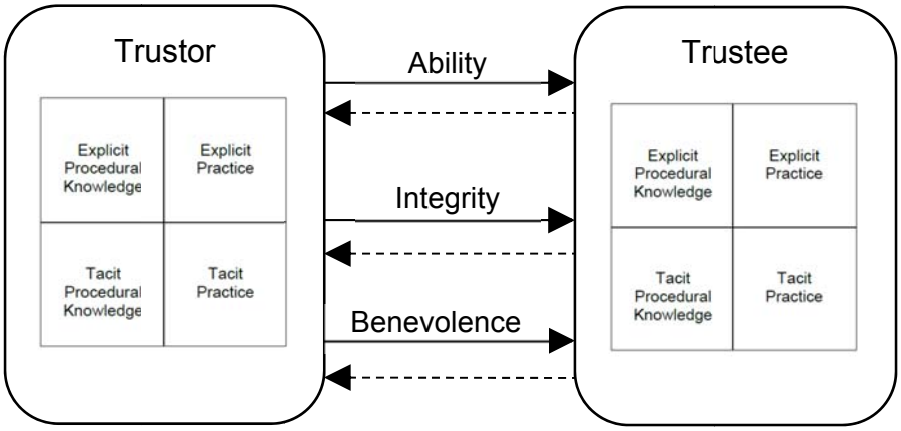
Relationship Phase	Sub-Group	Practical Knowledge Shared	Trust Antecedents	Observation (Characteristic, Uncharacteristic)	Knowledge Sharing Cycle No	Narrative Map Table Number
Relationship Conclusion	Both	Explicit Procedural Knowledge, Explicit Practice	Honesty	Characteristic	-	-
	SME	Explicit Procedural Knowledge	Honesty, Benevolence	Characteristic	1	Table F9
	Large	Explicit Practice	Honesty, Empathy, Ability	Characteristic	5	Table F10
	Large	Tacit Practice	Empathy, Judgment	Uncharacteristic	7	Table F10
Trust Development	Large	Continual sharing of practical knowledge and trustworthiness intensions of the trustor were met by the trustee				
		High social and technical reflexivity which lead to the transfer of some tacit to explicit practical knowledge				
	SME	Trust was not developed where low integrity was demonstrated by some companies who attended a forum				
		Low technical reflexivity and high social reflexivity which lead to no practical knowledge being shared				

Table 39: Summary of Findings for Research Question Three (Relationship Conclusion Phase)

Note:
Uncharacteristic practical knowledge type and trust antecedents are underlined

7.4 TRUST BASED PRACTICAL KNOWLEDGE SHARING FRAMEWORK

The trust based practical knowledge sharing framework shown in Figure 11 is based on the integrated organisational trust model originally developed by Mayer, Davis and Shoorman (1995) and Practical Knowledge taxonomy by Guzman (2009). Note that the proposed framework also takes inspiration from the mechanics of trust framework developed by Riegelsberger, Sasse and McCarthy (2005) and explicitly considers the sharing of practical knowledge and associated trust antecedents.



Key:

- Practical Knowledge and associated Trust Antecedent
- Trust Response Signal (Trust Descendent or Trust Antecedent of Practical Knowledge shared by other partner)

Figure 11 Trust based Practical Knowledge Sharing Framework

The framework shown in Figure 11 considers the knowledge associated with action and behaviours shared between two individuals, a trustor and trustee, and the associated trustworthiness intensions associated with such knowledge. The knowledge sharer is regarded as the trustor as it is considered that the act of sharing practical knowledge makes the individual vulnerable to the other individual, the trustee, who is in receipt of the knowledge. The rationale for this position being that the trustee may use the knowledge in a way that the trustor may not agree with.

The framework presented shows the typical trust antecedents as identified in the work of Mayer, Davis and Schoorman (1995), it should however be noted that other trust behaviours may also be examined. It is acknowledged that this framework simplifies what is considered to be a very complex process, however for the purposes of this exercise, the sharing of practical knowledge and associated trust related behaviours classified in terms of the four types practical knowledge as defined by Guzman (2009)are considered.

Considering the trust behaviours between a trustor and trustee when sharing knowledge, 'parity' in trust behaviours occurs when the trustworthiness intentions of the trustor are enacted by the trustee resulting in trust being developed: That is, when the trust descendent of the first knowledge sharing cycle is the same, or complementary to the trust antecedent of the same knowledge sharing cycle, or trust antecedent of the following knowledge cycle. Note that trust descendents are composed of behaviours and or actions only. This scenario may be considered as follows:

$TA_1 = TD_1$ *or* TA_2

Where TA_1 to TA_n are trust antecedents related to the first to *nth* knowledge sharing cycles and TD_1 to TD_n are trust descendents related to the first and *nth* knowledge sharing cycles. For example, TA_1, TD_1, or TA_2 may be related to for example ability related trust behaviours.

However, in the case where trust signals do not match, this may result in a 'disparity' in trust behaviours, which may result in trust not being developed as follows:

$TA_1 \neq TD_1$ *or* TA_2

Where for example TA_1 relates to ability and TD_1 or TA_2 relate to 'low judgment'. The descriptor of 'low' may be added where it is considered that the trustworthiness intensions of the trustor had not been met.

In the case of high value, high risk projects identifying key ways in which trust has, or has not been developed, may be important when learning from a project as an experience. Particular attention may also be drawn to instances where tacit practical knowledge has been exhibited, and associated trust behaviours that promoted or inhibited the sharing of such knowledge.

Based on the inspection of trust antecedent and practical knowledge classification data in narrative maps produced in this research, basic inferences can be made on trust and knowledge sharing behaviours. For example, Tables 40a and 40b present the trust and knowledge data captured from the narrative map for Case Study Six in Table F1 in Appendix F.

The tables present the trust antecedents (TAs) and trust descendents (TDs) used by the trustor and trustee and its location in the table indicates the type of practical knowledge that is shared by each partner. Subscripts have been allocated to each trust antecedent and descendent indicating the number of the knowledge sharing cycle used in the narrative map. There are essentially three types of knowledge sharing cycle, which are characterised as follows.

- The first cycle being where one partner or company (i.e. the trustor) shares practical knowledge based on their trustworthiness intentions (trust antecedents) being met and the other company (i.e. the trustee) responds with an action and behaviour, which signals trust behaviours (trust descendents) back to the trustor. Comparison of trust antecedents with descendents may provide some indication of how well trust is developed between both collaborating companies.
- The second type of cycle is where one partner shares practical knowledge and the second company responds by sharing practical knowledge back. In this scenario, both companies are trustors; however the trust antecedents of the second company when compared with the trust antecedents of the first company may provide some indication as to how well trust has been developed.

- The third type of cycle is which is a hybrid of types one and two, where one or both partners assume the roles of trustor and trustee.

The data in both tables is read by observing the trust antecedent in the trustor table and the corresponding trust descendent in the trustee table for a given knowledge sharing cycle. If both companies share practical knowledge one after the other, then both trust antecedents can be found in the trustor table where the knowledge sharing cycle numbers follow sequentially.

Inferences drawn from inspection of the trust and practical knowledge classification data in Tables 40a and 40b are as follows:

- There are two knowledge sharing cycles.
- Trustors appear to share explicit practice, based mainly on the trust antecedent of ability.
- At knowledge sharing cycle one, when sharing explicit practice, company two appears to want company one to demonstrate their ability and integrity (e.g. through execution of working practices in a suitable manner) and in doing so evidence their reliability. Based on company two's actions and behaviours, trust descendent one (TD_1) indicates that company one signals their ability and confidence to company two.
- When comparing the trust antecedents and trust descendents for both knowledge sharing cycles, the trust descendents enacted by trustees appear to match or complement the antecedents enacted by trustors, indicating that trust may be developed.

TRUSTOR			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2:	Company 1: TA_2: Ability Credibility Judgement	Company 2: TA_1: Ability Reliability Integrity
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 40a

TRUSTEE			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2:	Company 1: TD_1: Confidence Ability	Company 2: TD_2: Benevolence Judgement
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 40b

Tables 40a and 40b: Example Trust and Practical Knowledge Classification Data for Case Study Six (Relationship Formation

This example demonstrates that the inspection of trust behaviours alone help to develop some familiarity with the trust behaviours exhibited and any major differences that exist. This method may also prove particularly useful if a large amount of trust and knowledge data had been collated and key trust behaviours need to be identified quickly. These areas could then be analysed in more detail by reading the relevant narrative map and other operational records. It is however acknowledged that in some cases, where trust behaviours appear to be met by purely inspecting the data, in reality some operations may have been enacted that may be just within the margins of what may be deemed acceptable. For high risk operations, when such a scenario occurs, it may be preferable to make a note of this behaviour for future reference when collating data for the first time.

When considering disparities in trust behaviours over the life of a project, then these may form a unique pattern related to specific types of practical knowledge and working practices of a company as illustrated in Figure 12. Note that as this diagram is developed from figure 11, it also is based on the work of Mayer, Davis and Shoorman (1995), Guzman (2009) and Riegelsberger, Sasse and McCarthy (2005).

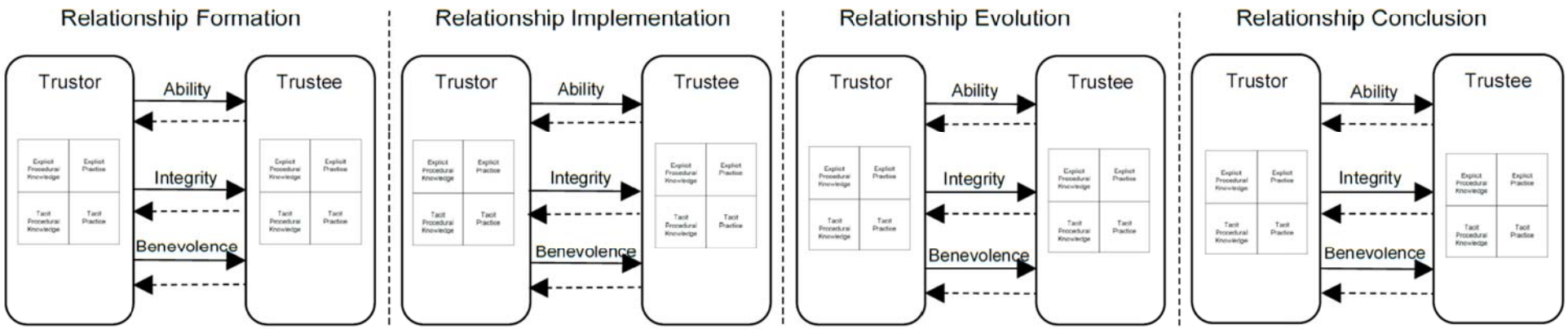


Figure 12 Trust based Practical Knowledge Sharing over the Project Life Cycle

Using trust antecedent and practical knowledge classification data from narrative maps from all four relationship phases in the Large company sub-group as shown in Appendix F, eight tables (Tables 41a and 41b to 44a and 44b) along with inferences are presented which together demonstrate how trust develops over the life of a project.

Tables 41a and 41b; 42a and 42b present the trust and knowledge data captured from the narrative map for Case Study Six in Table F2 for the relationship formation phase and Table F4 for the relationship implementation phase in Appendix F.

Inferences drawn from inspection of the trust and practical knowledge classification data in Tables 41a and 41b for the relationship formation phase are as follows:

- There are two knowledge sharing cycles.
- Trustors primarily share explicit procedural knowledge or explicit practice based mainly on the trust antecedent of ability.
- At knowledge sharing cycle one, when sharing explicit procedural knowledge, company one want company two to demonstrate their ability thereby helping to increase their confidence. In response, company two's behaviours and actions signal to company one that they have the ability to meet their requirements and do this in a manner that is agreeable to them (i.e. demonstrate integrity).
- One key trust antecedent utilised has been observed at knowledge sharing cycle two where empathy was utilised by company one. When sharing explicit practice, company one wants to understand company two's feelings or views on a specific issue and demonstrate its ability using the most appropriate working practices. In response, company two appears to take on board the views of company one and enact some actions and behaviours that signal their ability and integrity to company one.

- When comparing trust antecedents with trust descendents, in both knowledge sharing cycles, it appears that trustees signal or enact the trustworthiness intentions of trustors and in doing so, the trust descendents of trustees, mirror or complement the trust antecedents of trustors.

Inferences drawn from inspection of the trust and practical knowledge classification data in Tables 42a and 42b for the relationship implementation phase are as follows:

- There are eight knowledge sharing cycles.
- Trustors appear to predominantly share explicit practice, mainly based on the trust antecedents of honesty and judgement.
- At knowledge sharing cycle three, when sharing explicit practice company one want company two to demonstrate honesty and judgement. In response, company two appears to reciprocate the aforementioned behaviours when sharing explicit practice with company one.
- Uncommon behaviours are observed at for example knowledge sharing cycle six when sharing explicit practice, company two look to develop trust further with company one and in doing so demonstrate confidence and reliability.
- In most instances where company one shares explicit practice, company two shares explicit practice in return. As a result, no trust descendents (i.e. no TDs) are observed. In most knowledge sharing cycles, the trust antecedents of the second company appear to mirror or complement the trust antecedents of the first company and therefore trust appears to be developed in a mutual and reinforcing manner.

TRUSTOR			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1: TA_1: Ability Confidence	Company 2:	Company 1: TA_2: Empathy Integrity Ability	Company 2:
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 41a

TRUSTEE			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2: TD_1: Ability Integrity	Company 1:	Company 2: TD_2: Empathy Integrity Ability
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 41b

Tables 41a and 41b: Example Trust and Practical Knowledge Classification Data for Case Study Four (Relationship Formation Phase)

TRUSTOR			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2:	Company 1: TA_1: Ability Credibility TA_3: Honesty Judgment TA_5: Honesty Judgement TA_8: Honesty Judgement	Company 2: TA_2: Ability Honesty TA_4: Honest Judgement TA_6: Confidence Reliability TA_7: Honesty Judgement
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 42a

TRUSTEE			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2:	Company 1:	Company 2: TD_8 Honesty Judgement
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 42b

Tables 42a and 42b: Example Trust and Practical Knowledge Classification Data for Case Study Four (Relationship Implementation Phase)

Tables 43a and 43b; 44a and 44b present the trust and knowledge data captured from the narrative map for Case Study Six in Tables F7 and F8 for the relationship evolution phase and Tables F10 and F11 for the relationship conclusion phase in Appendix F.

Inferences drawn from inspection of the trust and practical knowledge classification data in Tables 43a and 43b for the relationship evolution phase are as follows:

- There are six knowledge sharing type cycles.
- Trustors appear to mainly share explicit procedural knowledge and explicit practice based on the trust antecedents of honesty and integrity.
- At knowledge sharing cycle one, when sharing explicit procedural knowledge, company one want their partner to demonstrate their ability through using the most appropriate working practices effectively and do this in an honest manner. In response, company two shares explicit practice that indicates its honest judgement(s) on one or a number of issues to company one.
- Uncommon knowledge sharing behaviours are observed at knowledge sharing cycle five when sharing tacit practice based on empathy, honesty and integrity, company one wanted company two to share their views on some working practices in an honest manner. The aforementioned trustworthiness intentions are signalled back by company two through the actions and behaviours enacted at trust descendent five (TD_5).
- Trust appears to be developed in a mutual and reinforcing manner through the reciprocal exchanges of explicit procedural knowledge and explicit practice, where both companies employ similar trust antecedents. One noticeable exception has been observed at knowledge sharing cycle six, when company two shares explicit practice, which requires company one to execute some action(s) based on integrity and honesty. This results in company one undertaking actions and behaviours that signal low ability and integrity back to company two, thereby indicating that trust may not have been developed on this occasion.

TRUSTOR			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1: TA_1 Ability Honesty,, Integrity	Company 2:	Company 1: TA_3 Ability, Honesty, Integrity	Company 2: TA_2 Honesty, Integrity, Judgement TA_4 Honesty Integrity Judgement TA_6 Honesty Integrity
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1: TA_5 Honesty, Empathy, Integrity	Company 2:

Table 43a

TRUSTEE			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2:	Company 1: TD_6 Ability low Integrity low	Company 2:
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2: TD_5 Honesty, Empathy, Integrity

Table 43b

Tables 43a and 43b: Example Trust and Practical Knowledge Classification Data for Case Study Four (Relationship Evolution Phase)

Inferences drawn from inspection of the trust and practical knowledge classification data in Tables 44a and 44b for the relationship conclusion phase are as follows:

- There are eight knowledge sharing cycles.
- Trustors appear to mainly share explicit procedural knowledge and explicit practice based on the trust antecedent of honesty.
- At knowledge sharing cycle five, company two shared explicit practice based on honesty, empathy and ability indicating that it wanted company one to share its honest views on working practices that had, or should be undertaken. In response at knowledge sharing cycle six, company one share explicit practice based on honesty, empathy and integrity which appears to indicate that they feedback honest views on working practices in a manner suitable to company two.
- Uncommon knowledge sharing behaviours are observed at knowledge sharing cycle seven, when sharing tacit practice based on empathy and judgement, company one want company two to share their views on some judgement related to one or a number of issues.
- In this phase, trust is mainly developed where the trustworthiness intentions of trustors appear to be met by trustees where the trust descendents enacted and signalled match or complement the trust antecedents of trustors. On a lower number of instances, trust development appears to take place through the reciprocal exchange of practical knowledge, where for example at knowledge sharing cycles five and six, explicit practice is shared by both partners where the trust antecedents utilised by the second company appear to match or complement the trust antecedents of the first company. One exception has been noted at knowledge sharing cycle two, where company one shares explicit procedural knowledge based on honesty and ability indicating that they would like company two to execute some action(s) to the best of their ability and in an honest manner. In response however, company two's actions and behaviours signal to company one that they have low integrity and confidence thereby indicating that trust may not be developed in this instance

TRUSTOR			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1: TA_2: Honesty Ability TA_3: Ability Reliability	Company 2:	Company 1: TA_4: Honesty Empathy Ability TA_6: Honesty Empathy Integrity TA_8: Empathy Judgement Integrity	Company 2: TA_1: Honesty Ability TA_5: Honesty Empathy Ability
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1: TA_7: Empathy Judgement	Company 2:

Table 44a

TRUSTEE			
Explicit Procedural Knowledge		Explicit Practice:	
Company 1:	Company 2: TD_2: Confidence low Integrity low TD_3: Empathy Judgement	Company 1: TD_1: Empathy Benevolence	Company 2: TD_4: Honesty Ability TD_8: Empathy Judgement
Tacit Procedural Knowledge		Tacit Practice:	
Company 1:	Company 2:	Company 1:	Company 2:

Table 44b

Tables 44a and 44b: Example Trust and Practical Knowledge Classification Data for Case Study Four (Relationship Conclusion Phase)

A summary of the main inferences made for each relationship phase can be found in Table 45.

Relationship Phase:	Basis for Trust Development:	Main Practical Knowledge types shared:	Other Notable Observations:
Relationship Formation	Ability	Explicit Procedural, Explicit Practice	Empathy facilitated sharing of Explicit Practice
Relationship Implementation	Honesty, Judgement	Explicit Practice	
Relationship Evolution	Honesty, Integrity	Explicit Procedural, Explicit Practice	Empathy facilitated sharing of Tacit Practice
Relationship Conclusion	Honesty	Explicit Procedural, Explicit Practice	Empathy facilitated sharing of Explicit Procedural, Explicit Practice and Tacit Procedural Knowledge

Table 45 Summary of Inferences from Trust and Practical Knowledge Classification Data

7.5 IMPLICATIONS FOR RELATED FIELDS

In this sub-section implications for the related fields of engineering practice and engineering education are presented.

7.5.1 ENGINEERING PRACTICE

This research provides insight into how trust influences the sharing of practical knowledge by facilitating the development of a shared understanding between two collaborating partners. The investigation also identified how the role of trust changes when developing collaborative relationships over the project life cycle. This dynamic relationship between trust and practical knowledge sharing presents both large companies and SMEs with challenges when developing new products, processes and services. For example, when working on high value or high risk projects where the relationship between the requirements of project stakeholders are complex, a fine balance between trust behaviours and appropriate type of practical knowledge may need to be observed for relationships to develop, or even remain intact.

The research process and associated methods in this investigation provide a way of improving existing working practices, or identifying new ways of working, by

learning how trust has been developed and practical knowledge has been shared within a project.

The central challenge for SMEs to use the methods as outlined in this research is to develop a practical knowledge sharing culture, which is characterised by norms, values and beliefs that promote trust at both the inter-personal and higher levels where institutional trust can be developed. This could be facilitated through conducting a number of internally focussed trial projects where narrative maps could be developed to identify areas where trust could be developed further. After implementing the results from such projects, this may help to promote trust between team members and help to build confidence in using the methods themselves.

The benefits from the internally focussed trial projects could then be shared with an external partnering company, who may then buy in to using the methods and participate in a number of externally focussed trial projects with the SME. Before undertaking trial projects, the following items should be noted:

- Personnel may view the capture of trust behaviours as *'going a step too far',* or even being unethical. As a result, some protocols may need to be established on the format of data that should be recorded such as behaviours related to project issues and not personal actions.
- Protocols may also need to be established for different forms of practical knowledge sharing with different external partnering companies, as there could be issues relating to intellectual property that may need to be agreed. For example, some partnering companies may not initially feel comfortable sharing practical knowledge in some business functions where extensive experimental work is conducted and where the work is highly tacit in nature.
- The methods as outlined in this research also require that trust and practical knowledge data to be captured at different relationship phases. This means that agreement would have to be obtained as to what data could be collated between teams internally and teams from other external patterning companies. It may therefore be that one partner either within a company or

in another external partnering company may not agree to capture data in the same relationship phases. To maximise the benefit realised from a project, it would be beneficial for both partners to collate data related to the same relationship phases.

When considering software systems to capture trust and practical knowledge data, SMEs have two options on how such systems could be used.

- Use the existing information systems and create functionality within each system to record the data.
- Acquire one web based system to record trust and practical knowledge sharing data that is used stand-alone or has the functionality to link up with a company's existing systems.

In a bid to save money, SMEs may choose to capture data using their existing setup, which may also be acceptable in the case where an SME is not sharing data with another partnering company. However when SMEs are looking to share data with another collaborating company, it may be desirable to use a web-based system that allows personnel to create reflective comments on their own actions and trust behaviours. Ideally in both scenarios, usage of a web-based system would be best, as this would enable a company to share data internally or with other external collaborating partners.

For an SME that is looking to implement the methods outlined in this research at a minimum cost and to maximise the benefits realised, then perhaps they should focus on collating trust and practical knowledge data in the relationship evolution phase. This research has demonstrated that the most significant benefits may be realised from capturing more tacit forms of practical knowledge at this relationship phase. It is particularly important to provide sufficient contextual and behavioural data, which provides the reader with a good understanding of how knowledge has been shared. In addition to promoting a practical knowledge sharing culture, the captured informal learning experiences, may also provide senior management with insight into the learning development of team members

and therefore enable them to identify new capabilities that could be utilised on other projects.

7.5.2 ENGINEERING EDUCATION

This research proposes that trust and the sharing of practical knowledge could be taught as learnable skills within the context of engineering ethics.

Ethics is typically covered in both engineering undergraduate and postgraduate programmes either as a stand-alone course or integrated within specific aspects of a number of modules. For engineering practitioners, it is believed that the integrative option is the most effective way to learn about ethical issues as they are being considered from a specific aspect of engineering and therefore being taught in a purposeful way. Studying ethics in this manner allows students to consider specific cases, where for example Harris, Davis and Rabins (1996) note that moral problems that face engineers in everyday experiences can be analysed in two formats. First of all, cases can be analysed where moral dilemmas are observed with the student required to *'draw the line'* as to what is acceptable and unacceptable engineering practice (Harris, Davis and Rabins 1996). Another type of case is that of a *'conflict problem',* where stakeholders have competing or conflicting requirements and the student is required to find a solution that meets the requirements of all or most stakeholders, whilst also being ethical (Harris, Davis and Rabins (1996).

It is important to note, that the cases should be real life in nature and require students to demonstrate transdisciplinary skills, which Tan et al. (2018) characterise as the *"ability to think in a complex and interlinked manner",* thereby giving students the ability to tackle problems that are related to both engineering and non-engineering issues.

Trust and the sharing of practical knowledge could be introduced into the engineering ethics part of a module where trust could be characterised in terms of its separate components of trust antecedents, trust propensity and trust outcomes from Mayer, Davis and Schoorman's (1995) trust model. The trust based practical knowledge sharing framework as devised in this research could

also be used and the role of trust in the development of collaborative relationships.

Paying particular attention to the concept of trust antecedents, students could then be introduced to the most common forms of antecedents, for example ability, integrity, benevolence and empathy. At this point, students could then analyse trust related issues in ethical cases. At a basic level, when examining ethical *'draw the line or conflict'* cases, trustworthiness issues could be analysed in broad terms related to key trust antecedents from example transcript extracts.

At a more advanced level, students could be taught the method of narrative mapping and transcripts related to specific cases could be analysed in groups using narrative maps. Group exercises could also be extended further, where different ethical cases could be assigned to a number of groups. In each group, a small number of students may assume the role of a key stakeholder, who would be interviewed by some of the remaining group members, while also recording what has been said. The notes or transcripts produced could then be analysed using narrative maps by all group members.

7.6 LIMITATIONS AND FURTHER WORK

Although the research undertaken addressed the research questions and research aim, a number of limitations and areas for further work have been identified as follows.

In the current research, a sample size of six participants was investigated where the aim of the research was to compare the findings by company size. Even though the participants were taken from a number of industry sectors, the analysis did not investigate any deviations in working practice by industry sector. It is acknowledged that while the objective was not to generalise the findings, similar further research that specifically investigated differences in trust behaviours and the ways in which practical knowledge is shared in different industry sectors could be undertaken. This research would help to identify if the working practices were influenced by the type of industry sector.

Given that one person was interviewed for each case, it could be argued that the anecdotes represented half of the stories that were analysed. It should however be noted that every effort was made to ensure that the accuracy and trustworthiness of data was achieved by undertaking the following activities:

- Multiple methods were used to collect data from primary and secondary data sources such as semi-structured interviews, observations and field note taking of interview experiences and key characteristics from company websites.
- Semi-structured interviews were conducted with an interview guide to ensure consistency and minimise misinterpretation in the way questions were answered by participants.
- Where appropriate, the researcher reflected with the participant to make the researcher's views transparent.
- Detailed transcriptions were made of each interview, which were captured as an audio recording.
- All interviews ended with a debriefing to review what had been covered and give the participant the opportunity to ask any questions that they had.

To overcome the limitation of interviewing one person, a similar explorative study to the current initiative could be undertaken where participants could be interviewed in groups of two or more people. Conducting interviews in this manner would help to improve the accuracy of the participants' accounts; however this would present numerous methodological challenges in transcribing the data and using it to develop narrative maps.

To effectively collate data related to companies' working practices requires spending a long period of time in their respective environments. For example, notable practice based research such as that conducted by Gherardi (2006) and Lave and Wenger (1991) have conducted longitudinal studies when developing their models. Longitudinal studies could not be conducted in the current research as the investigation was restricted by time limitations. In addition, when collecting

cross-sectional data, the following strategies were undertaken to reduce the negative impact on the research outcomes:

- Multiple data collection methods were used when collecting qualitative data for all case studies.
- Observations were conducted over a period of three weeks in Company A for case study one where additional detailed reflective observation notes were taken.
- Detailed field notes were taken to support the interviews that were conducted for all case studies.
- Participants were chosen from a wide and varied number of job roles in both sub-groups.

Future research could be undertaken longitudinally using a similar sample size to that of the current research, where ethnographic observations could be carried out for each case. Research carried out in this manner would provide more accurate insight into the trust and practical knowledge sharing behaviours of engineering practitioners in their respective organisations.

Asymmetry in collaborations appeared to be most evident in the first two relationship phases where the larger company appeared to exercise its power in the respective collaborative partnerships. Whilst such behaviour was acknowledged and discussed in the analysis it was not investigated in any great depth. Further research could investigate how power asymmetries influence trust behaviours, the sharing of practical knowledge and the selection of associated knowledge sharing mechanisms for all four relationship phases. It is noted in particular, that previous research such as that conducted by Guzman (2008) has commented on the need to investigate how political issues influence knowledge sharing behaviours.

Further research could use the findings from the thematic analysis for research questions one and two, where factors related to key themes could be analysed in a larger scale quantitative study using a survey instrument. By adopting such a

research design, a survey could be used to analyse how cultural factors influence trust and practical knowledge sharing behaviours. In addition, specific demographic data such as gender, age and experience could be utilised to understand how individuals' characteristics influence trust behaviours and the way practical knowledge is shared in all four relationship phases.

In the current research, the utility of discussion forums had been observed particularly in its ability to facilitate the sharing of various forms of practical knowledge. Further research could develop the narrative mapping method by integrating its functionality into various knowledge management systems that are used by companies in each relationship phase. Using predefined performance metrics, the effectiveness of the narrative mapping method could be investigated by taking performance measures before and after implementing the changes to the systems after a period of time.

While the current investigation considered a low level of trust antecedent or descendent, where low trust was demonstrated as a separate and distinct item, the research did not however, consider distrust, as trust and distrust can be viewed as separate and distinct constructs. Research conducted by Robinson, Shaver and Wrightsman (1991) for example has shown that trust beliefs are separate and distinct from distrust beliefs and therefore trust and distrust cannot be viewed as opposite ends of the same continuum.

Research conducted by Lewicki, McAllister and Bies (1998) has however demonstrated that trust and distrust can coexist in the case of ambivalence. When ambivalence is experienced, individuals have both positive and negative attitudes towards a single target item as noted for example by Otnes, Lowrey and Shrum (1997). When developing a trust/distrust model based on ambivalence, Lewicki, McAllister and Bies (1998) noted that separate and distinct antecedents can exist for both positive and negative attitudes.

Using the same research design as utilised in the current investigation, further research could be undertaken where distrust could be introduced alongside trust in the cases where ambivalence was observed. In addition, distrust could also be

considered as related to separate and distinct actions and behaviours. When considering the inclusion of distrust into the analysis, this would also mean that the narrative mapping method would need to be developed and additional protocols introduced to accommodate for its inclusion.

7.7 CONTRIBUTION TO KNOWLEDGE

The main contributions from this research are as follows:

- A Narrative Mapping Method
- The Research Outcomes for Research Question Three
- Validation of existing conceptual models
- Trust based Practical Knowledge Sharing Framework

- A Narrative Mapping Method

The primary contribution of this research is the narrative mapping method which is composed of narrative maps and a map building process, which is presented in the research methodology chapter of this thesis.

The structure of the narrative map is primarily based on a trust based practical knowledge sharing model, which adapts the integrative trust model as developed by Mayer, Davis and Shoorman (1995) to consider the sharing of practical knowledge between a trustor who is considered to be the knowledge sharer and trustee who is the knowledge recipient.

Additional novel features of a narrative map include the practical knowledge sharing cycle, which is composed of a set of behaviours, actions, trust antecedents and practical knowledge shared from one partner and the responding behaviours, actions and trust descendents from the second partner.

Trust descendents, take inspiration from relational signalling theory as proposed by Lindberg (Kramer and Lewicki 2010), where a partner's behaviours and associated actions signal to the trustor whether their requirements are being met, thereby facilitating the development of trust.

The narrative mapping method also provides a valuable function as it illustrates how trust develops through the exchange of practical knowledge. As the method relates primarily to the areas of trust and sharing of practical knowledge it is considered that the method contributes to the trust and practice theory literature areas.

- Research Outcomes for Research Question Three

Applying the narrative mapping method to participants' anecdotes related to the four relationship phases has enabled the research to present a holistic view of how trust influences the practical knowledge sharing process over the project life cycle.

To date, numerous research initiatives have been undertaken that investigate the relationship between trust and knowledge sharing however, no research has been undertaken that specifically investigates the relationship between trust and the sharing of practical knowledge. In general terms, research on practical knowledge has been undertaken that acknowledges the importance of trust for example, Orlikowski (2002) has commented that socialisation processes build trust, credibility and respect all of which facilitate the sharing of practical knowledge. A practical knowledge sharing framework has also been proposed by Tunsi, Guzman and Shacklock (2012), however this framework does not specifically consider the influence of trust.

The findings for research question three provide insight into how trust antecedents are used when sharing specific types of explicit and tacit practical knowledge. These observations have been collated in such a manner that enabled the research to build a picture of how trust and practical knowledge interacted over the life of a project. In light of these findings, it is proposed that the outcomes for research question three provide a contribution to both the trust and practice theory literature areas.

- Validation of existing conceptual models

The findings from research question three appear to agree with the forms of trust outlined in the trust development model proposed by Nielsen (2004) and as such it is proposed that this research has validated this model. It is however important to note that there are some minor differences that can be explained by taking a closer examination of the two. The trust types observed in Nielsen's model in the relationship implementation phase is deterrence trust and in the relationship evolution phase is calculus and deterrence trust. The trust types observed in this research in the same relationship phases were deterrence, cognitive and calculus trust respectively. The trust types outlined by Nielsen (2004) appear to reflect trust development in new relationships, when deterrence and calculus trust are more prevalent (Shapiro, Sheppard and Cheraskin 1992). The trust types observed in this research however, are characteristic of more mature relationships as noted by Lewicki and Bunker (1996) where the relationships described by participants had some experience of working with each other.

The knowledge sharing behaviours observed in the relationship evolution phase in this research also appear to agree with two propositions presented in the conceptual trust reflexivity model as proposed by Sankowska and Söderlund (2015), where high social and technical reflexivity appeared to lead to the sharing of both explicit and tacit practical knowledge. In addition, low technical reflexivity and high social reflexivity also appeared to result in no practical knowledge being shared. Given the observations that have been made, it is proposed that this research has validated two propositions of Sankowska and Söderlund's (2015) trust reflexivity model.

- Trust based Practical Knowledge Sharing Framework

The trust based practical knowledge sharing framework proposed is based on Mayer, Davis and Schoorman's (1995) integrative trust model and Guzman's (2009) practical knowledge taxonomy or model. The framework is a graphical depiction that describes the relationship between a trustor and trustees' trust and practical knowledge sharing behaviours. As such, the framework provides a means by which to compare trust and practical knowledge data, thereby enabling

the researcher and practitioner to analyse how trust has developed and the associated practical knowledge shared.

The framework also provides practitioners with a functionality that would enable them to collate trust and practical knowledge sharing data, with new or existing knowledge management, or related information systems. It is envisaged that the benefit realised from integrating such functionality would be proportionate to the number of relationship phases an organisation's knowledge management system(s) operates in. It is proposed that the framework provides a contribution towards theory in the trust and practice theory literature areas, and engineering practice itself.

In addressing the question *"what do we know now, that we didn't know before*?", an over-arching novel contribution has been produced from the findings for research question three. This investigation has shone new light on the trust antecedents observed when sharing different types of practical knowledge during the life of a project. More specifically, at the relationship evolution phase, explicit procedural knowledge appeared to be shared on the basis of ability, and explicit practice was shared on the basis of empathy and judgment for both sub-groups.

The most significant finding that has been observed, in both the relationship evolution and conclusion phases, has been where empathy appeared to strongly facilitate the sharing of tacit procedural knowledge and tacit practice.

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9 APPENDICES

APPENDIX A: PARTICIPANT INFORMATION SHEET

APPENDIX B: PARTICIPANT CONSENT FORM

APPENDIX C: SCREENING QUESTIONNAIRE

APPENDIX D: INTERVIEW GUIDES

APPENDIX E: LIST OF TRUST ANTECEDENTS USED IN NARRATIVE MAPPING

APPENDIX F: NARRATIVE MAPS

NOTES AND INSTRUCTIONS FOR READING NARRATIVE MAPS

APPENDIX A:

PARTICIPANT INFORMATION SHEET

Research Project Title, Aim and Questions:
An investigation into the influence of Trust on the sharing of Practical Knowledge in Technology Producing Small to Medium Enterprises (SMEs).

The aim of this project is to formulate a framework which provides insight into how Trust influences the sharing of practical knowledge in technology producing Small to Medium Enterprises (SMEs).

The Research Questions for this project are as follows:
1 What are the main characteristics of a trust based practical knowledge sharing culture within the sample of SMEs and large companies?
2 What are the specific perceptions and experiences of engineering practitioners who adopt trust based strategies for sharing practical knowledge?
3 What are the specific perceptions and experiences of engineering practitioners that demonstrate how trust is constructed and how this influences the way practical knowledge?

Research Approach and Outcomes:
This research project will adopt a qualitative approach using Ethnographic Case Studies to ascertain the actions and behaviours of personnel when opportunities occur to share Practical Knowledge within a workplace setting.

A Screening questionnaire followed by two Semi-Structured Interviews will be used to gain insight into the trusted based practical knowledge sharing experiences of participants in the following types of activities:
- Partner identification, selection and initial trust building;
- Contract Negotiation and Development;
- Project based Informal Learning;
- Project Evaluation through collective reflection with Project Partner Organisations.

Please note that Participants will be screened based on the responses produced for the Screening Questionnaire and the second stage Semi-Structured Interview.

This research project will deliver the following outcomes:
- A trust based practical knowledge sharing framework will be formulated with associated empirical phenomena that outlines how trust influences the sharing of practical knowledge;
- Guidelines on how to apply the trust based practical knowledge sharing framework;
- Implications for Engineering Practitioners in SMEs and Engineering Education.

Informed Consent:
Before each interview begins, each participant will be given a background to the project and invited to complete an Informed Consent Form.

Permission will also be sought from each participant to make a digital recording of each interview. A transcript will be produced from each recording, which will be sent to the participant for review and comment.

How information will be stored and published:
All information provided will remain anonymous and confidential. Although, I will ask you to complete your name on a Research Participant Consent Form, this is the only time I will ask for it. Any specific help that is provided towards this research will not ask for your name. In addition, any written information e.g. transcript from interviews will be stored in a secured location, which I will only have access. Any electronic information will be password protected and again, this will only be accessed by myself.

Northumbria University
NEWCASTLE

Any information that is provided will only be analysed by myself, it will be completely anonymised and presented in a format that will not identify you to anyone else. The information will be used only for the purposes of this research project, that is, for the purposes of developing ideas and my PhD thesis.

Anonymised information may also be presented at Conference presentations, or in Journal articles to explain the findings of the research.

This project was approved by the Northumbria University, Faculty of Engineering and Environment, Ethical Approval Process on 12th October 2015.

Contact Details:

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APPENDIX B:

PARTICIPANT CONSENT FORM

Name of participant	
Organisation	
Researcher's name	Mr. Neil Parkin
Title of research project/dissertation	An investigation into the influence of Trust on the sharing of Practical Knowledge in Technology Producing Small to Medium Enterprises (SMEs).
Programme of study	Doctor of Philosophy (PhD)
Supervisor's name	Dr. R. Penlington

Brief description of research and involvement of participant:

This research will investigate the Practical Knowledge sharing behaviours of personnel in Small to Medium Enterprises and in particular the role of Trust. The main outcomes of the research are outlined below:

- A trust based practical knowledge sharing framework will be formulated with associated empirical phenomena that outlines how trust influences the sharing of practical knowledge;
- Guidelines on how to apply the trust based practical knowledge sharing framework;
- Implications for Engineering Practitioners in SMEs and Engineering Education.

Case Study research will be conducted within a number of SMEs, where participants will be interviewed. An Initial Screening Questionnaire will be completed to identify personnel and working practices related to practical knowledge sharing of specific interest. A Semi-Structured interview will then be conducted to gain insight into how trust develops whilst sharing explicit practical knowledge during the life of a relationship with one or more project partners. A second Semi-Structured interview will then be conducted at a later time to gain further insight into how trust influences the sharing of tacit practical knowledge with one or more project partners.

In accordance with the Data Protection Act 1998, we are required to request your permission to use your information in our research.

Stage 1: Screening Questionnaire
Statement of Participant Consent (please tick as appropriate):

I confirm that:

I have read and understand the purpose of the study	☐
I have been given the chance to ask questions about the study and these have been answered to my satisfaction	☐
I am willing to complete a Screening Questionnaire	☐
I understand that I can withdraw at any time if I change my mind	☐
I am aware that my name and details will be kept confidential and will not appear in any printed documents and that information will be anonymised before being shared.	☐
I understand that any data collected may be used in printed documents but that all data used will be completely anonymised so that none of the individuals and organisations that have taken part can be identified.	☐
Would you be willing to take part in a Follow-Up Interview?	Yes/No

Stage 2: Follow-Up Interview
Statement of Participant Consent (please tick as appropriate):

I confirm that:

I have read and understand the purpose of the study	☐
I have been given the chance to ask questions about the study and these have been answered to my satisfaction	☐
I am willing to participate in a Semi-Structured interview	☐
I am willing for my comments to be recorded	☐
I understand that I can withdraw at any time if I change my mind	☐
I am aware that my name and details will be kept confidential and will not appear in any printed documents and that information will be anonymised before being shared.	☐
I understand that any data collected may be used in printed documents but that all data used will be completely anonymised so that none of the individuals and organisations that have taken part can be identified.	☐
Would you be willing to take part in a Follow-Up Interview?	Yes/No

Stage 3: Follow-Up Interview
Statement of Participant Consent (please tick as appropriate):

I confirm that:

I have read and understand the purpose of the study	☐
I have been given the chance to ask questions about the study and these have been answered to my satisfaction	☐
I am willing to participate in a Semi-Structured interview	☐
I am willing for my comments to be recorded	☐
I understand that I can withdraw at any time if I change my mind	☐
I am aware that my name and details will be kept confidential and will not appear in any printed documents and that information will be anonymised before being shared.	☐
I understand that any data collected may be used in printed documents but that all data used will be completely anonymised so that none of the individuals and organisations that have taken part can be identified.	☐
Would you be willing to take part in any follow-up communication if required?	Yes/No

Information will only be used for the purposes to which you agree and it will be kept in a secure environment and disposed of when the project has ended.

All information given will be anonymised and none of the participants will be identifiable in the project report or other publications. Copies of any reports or publications will be made available on request to participants.

Research Participant Signature:

I have been given a copy of this Informed Consent Form.

Signed ..... **Date** .....

Standard statement by researcher
I confirm that I have explained the project to the research participant and believe that he/she understands what is involved.

Researcher's signature……

Date……

Northumbria University
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Contact Details:
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APPENDIX C:

STAGE ONE SCREENING QUESTIONNAIRE:

Name of participant:	
Organisation:	
Researcher's name:	Mr. Neil Parkin
Title of research project:	An investigation into the influence of Trust on the sharing of Practical Knowledge in Technology Producing Small to Medium Enterprises (SMEs).
Supervisor's name:	Dr. R. Penlington

1 Personal Details:

a Gender: *(Please check appropriate option):*

	Male	
	Female	
b Age:	25 to 35 years	
	36 to 45	
	46 to 55	
	56 plus	

c First Degree Education:

Subject *(e.g. Engineering, Chemistry etc.)*	
Study Mode: *(e.g. Full Time, Part Time)*	
Age when started:	

d Postgraduate Education:

Subject *(e.g. Business, Engineering etc.)*	
Study Mode: *(e.g. Full Time, Part Time)*	
Age when started:	

e Vocational and Professional Education *(if held):*

Subject *(e.g. BTEC, CEng, NEBOSH)*	
Study Mode: *(e.g. Full Time, Part Time)*	
Age when started:	

2 Company Details:

a Company Size *(number of staff):*	
b Date Company founded *(Provide approximate Year):*	
c Company products/services (e.g. exhaust systems, machine installation):	
d Related Company information *(e.g. Subsidiary Company of Nissan, Japan):*	

3 Overview of Role:

a Can you briefly describe your current role within your organisation? *(Please provide your response in this box)*	
b How long have you worked in the organisation? *(Years):*	
c Have you worked for any organisations which are customers or suppliers of your current organisation?	Yes/No

4 As part of your current or previous roles undertaken have you had experience of carrying out the following activities?

a *Identifying and selecting one or a number of organisations to collaborate with (e.g. technology development, product or service supply)?*	Yes/No
b Participated in the negotiation and development of a contract with one or a number of project partner organisations?	Yes/No
c Informal learning with others (e.g. work based learning, shadowing) was undertaken by yourself/or facilitated (e.g. Supervisor, Mentor) by you on a project?	Yes/No
d Engaged with one or a number of people to review the lessons learned from a project or issues faced by an organisation, which required you to reflect collectively with others (e.g. project evaluation, brainstorming session)?	Yes/No

5 For those questions 4a to d, for which you replied **Yes**, can you please provide one example for each:

(Please provide your response in this box)

Thank You For Your Time

Contact Details:
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APPENDIX D:

STAGE TWO: FOLLOW-UP IN-DEPTH SEMI-STRUCTURED INTERVIEW GUIDE (60 Minutes)

Name of participant:	
Organisation:	

Note: In the case of one participant being interviewed. The BIOGRAPHICAL QUESTION and TWO anecdotes are required (if possible) for each of the relationship areas.

BIOGRAPHICAL QUESTION:

1 Can you tell me about yourself? How you became an engineer? Influential events, people, objects in your past. Perhaps expand on items put in the Screening Questionnaire.
2 Given the range of companies you have worked in, have you noticed any changes in the way you have shared Practical Knowledge (or Practical Knowledge has been shared with you) and associated trust behaviours?

RELATIONSHIP FORMATION:

3 Can you tell me an anecdote(s) about how you have gone about identifying and selecting one or a number of project partners? If no mention of trust antecedents, ask about initial trust building.

RELATIONSHIP IMPLEMENTATION:

4 Can you tell me an anecdote(s) about where you have participated in the negotiation and development of a contract with one or a number of project partner organisations?

RELATIONSHIP EVOLUTION:

5 Can you tell me an anecdote(s) about scenarios where informal learning was undertaken by yourself with others/or facilitated by you on a project?

RELATIONSHIP CONCLUSION:

6 For a project that has already completed, can you tell me anecdote(s) about how the lessons learned from a project have been evaluated with one or more project partners, whether done formally or informally? I am particularly interested where project partners have come together to reflect in a collective manner.

7 Given the key knowledge sharing experiences discussed, did the Outcomes produced meet your own and the other project partner's expectations from that initially envisaged?

8 Thinking about key experiences when outcomes have not been as expected at any stage of a project. Have there been any changes (mechanisms) in the ways Practical Knowledge is shared and the willingness of the Trustor to share Practical Knowledge/Trustworthiness of the Trustee going forward?

9 If no areas related to Tacit Procedural Knowledge or Practice have been identified, then ask recipient if there are any items (i.e. actions, behaviours, and outcomes) related to knowledge sharing that could not be explained fully?

10 Is there any publicly available documentation for the projects discussed?

11 Do you have any questions you would like to ask me?

ETHNOGRAPHIC SUB-QUESTIONS FOR QUESTIONS 2 TO 5:

Ethnographic Sub-Questions should be applied where appropriate to help participant develop a short story or anecdote. See separate Ethnographic Sub Question List.

TRUST ORIENTED PROBES FOR QUESTIONS 2 TO 6:

TRUSTOR:

a If no mention of Trust, how did the Trustee's Ability (Skills, Abilities), Integrity (way in which they work); and Benevolence (have the interest of the project at heart) influence the way in which you shared your knowledge?

TRUSTEE:

b If no mention of Trust: What are your perceptions of the Trustor's willingness to share practical knowledge?

ETHNOGRAPHIC SUB QUESTION LIST

(Relevant to Stage 2 and Stage 3 Interview Guides in this Study):

1 Descriptive Questions
- 1.1 Grand Tour Questions:
  - 1.1.1 Typical Grand Tour Questions
  - 1.1.2 Specific Grand Tour Questions
  - 1.1.3 Guided Grand Tour Questions
  - 1.1.4 Task Related Grand Tour Questions
- 1.2 Min Tour Questions:
  - 1.2.1 Typical Grand Tour Questions
  - 1.2.2 Specific Grand Tour Questions
  - 1.2.3 Guided Grand Tour Questions
  - 1.2.4 Task Related Grand Tour Questions
- 1.3 Example Questions
- 1.4 Experience Questions
- 1.5 Native Language Questions
  - 1.5.1 Direct Language Questions
  - 1.5.2 Hypothetical-Interaction Questions
  - 1.5.3 Typical –Sentence Questions

2 Structural Questions
- 2.1 Verification Questions
  - 2.1.1 Domain Verification Questions
  - 2.1.2 Included Term Verification Questions
  - 2.1.3 Semantic Relationship Verification Questions
  - 2.1.4 Native-Language Verification Questions
- 2.2 Cover Term Questions
- 2.3 Included Term Questions

3 Contrast Questions

3.1 Contrast Verification Questions

3.2 Direct Contrast Questions

3.3 Dyadic Contrast Questions

3.4 Triadic Contrast Questions (if required)

STAGE THREE: FOLLOW-UP INTERVIEW GUIDE (60 Minutes)

Name of participant:	
Organisation:	

Note: Follow-Up may be done by e-mail if no opportunities to probe for Tacit Procedural Knowledge or Practice have been identified).

1 Follow-Up Questions and Key Narratives from anecdote(s) related to the identification, selection and initial trust building with one or more project partners:

(Insert Follow-Up Questions and Key Narratives from anecdotes in this box)

2 Follow-Up Questions and Key Narratives from anecdote(s) related to the contract negotiation and development with one or more project partners:

(Insert Follow-Up Questions and Key Narratives from anecdotes in this box)

3 Follow-Up Questions and Key Narratives from anecdote(s) relate to informal learning, either undertaken with others or facilitated by the participant:

(Insert Follow-Up Questions and Key Narratives from anecdotes in this box)

4 Follow-Up Questions and Key narratives related where the participant has engaged in (formal or informal) project evaluation activities where the participant has engaged with one or more project partners to reflect in a collective manner:

(Insert Follow-Up Questions and Key Narratives from anecdotes in this box)

5 Do you have any questions you would like to ask me?

APPENDIX E:
LIST OF TRUST ANTECEDENTS USED IN NARRATIVE MAPPING

ABILITY

INTEGRITY

BENEVOLENCE

TRUTH/HONESTY

CONFIDENCE

RELIABILITY

LIKEABILITY

GOODWILL

FAITH

FAIRNESS

HABITUALIZATION

INSTITUALIZATION

DEPENDABILITY

CREDIBILITY

JUDGMENT

RESPONSIBILITY

PREDICTABILITY

DEPENDABILITY

EMPATHY

HUMILITY

PATIENCE

TOLERANCE

RECIPROCITY

APPENDIX F: NARRATIVE MAPS

NOTES AND INSTRUCTIONS FOR READING NARRATIVE MAPS

Notes:

- Narrative maps are extracts of narrative composed of one, or a number of knowledge sharing cycles, which can be initiated by one company (large company of SME) or the other company. The company for which the participant worked for in each case is regarded as the focal company.
- One knowledge sharing cycle is composed of a behaviour, action, trust antecedent and practical knowledge shared for one partner (or trustor) and responding behaviour, action and trust descendant from the other partner (or trustee).
- All knowledge sharing cycles are numbered at the trust antecedent and this indicates the order in which practical knowledge with its associated behaviours and actions are shared.
- If a knowledge sharing cycle has no responding behaviour, action and trust descendant, then the second cycle has been initiated by the other partner where practical knowledge is shared in response to the first or previous cycle.
- A knowledge sharing cycle may be initiated by the participant's company (focal company) or the other company.
- Depending on the availability of information in the transcript, behaviours and actions have been mapped, however in some instances it may be that a behaviour, or an action has been mapped by themselves.
- As the interviewee may not discuss facts in order, the knowledge sharing cycles may not be presented in numerical order from top to bottom on a map.
- Where follow-up interviews have been undertaken, some knowledge sharing cycles may be mapped on a separate narrative map.

Instructions for reading Narrative Maps:

1 Read the transcript to develop some familiarity with the anecdote.

2 Read each knowledge sharing cycle in numerical order according to the number assigned at its trust antecedent from left to right, for each collaborating partner.

3 When reading each knowledge sharing cycle, if narrative data exists that is not in line with the cycle that is being read, then this should be considered as ancillary or supporting data to all knowledge sharing cycles enacted by the relevant company.

	Response:	RQ No:	MAP FILTER	Behaviour (TA) (SME)	Action (SME):	Trust Antecedent (SME)	PKS (What/How) (SME):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co	PKS (What/How) (Other Co):	Behavour (TD) (SME):	Trust Action (SME):	Trust Descendent (SME)	Outcome
Interviewer	Okay. That's question two. Question three I'm going to refer to your screening questionnaire. I'll have to get it out. Right, the first area, relationship formation, this is for question three, one of the areas you mentioned that you had experiences in or anecdotes was subcontract materials and component supply. Erm I guess all these areas are related to here.	RQ3A1 (For Ref); RQ3A2 (For Ref)	RQ3A1 MAP (For Ref); RQ3A2 MAP (For Ref);																
Interviewer	Okay. Have you got any other examples, erm previous life, probably in your previous job [Company H2] where you've had some unusual circumstances trying to identify people? Or has it been…	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	Erm…yeah. I mean we would use, obviously, you know, engineering it's always a case of looking to reduce cost or something.	RQ3A2	RQ3A2 MAP	At Company H2, Frank it was accepted practice to look to reduce costs in everything they did.															
Participant	So my previous job we did a lot of work for this company called Company J2, who make stuff for…	RQ3A2	RQ3A2 MAP		Company H2 did a lot of press work for Company J2														
Participant	No. Big company based in the North East. Where they make seals for the automotive industry.	RQ3A2	RQ3A2 MAP									Company J2 was based local to Company H2, who made seals for the Automotive Industry.							
Participant	Erm and obviously being automotive it's all about reducing cost and things like that.	RQ1:RQ2; RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	Erm and we were a pressings company so it was really raw material was your main thing, and I guess tooling.	RQ3A2	RQ3A2 MAP	Company H2 was a pressing company and so their work mainly involved using various types of tooling.															
Participant	Uh-hm. Raw material was dictated by them because they had…they're a massive global company so they had, you know, an awful lot of purchasing power. Tooling was really down to ourselves. Finding people who would do the tooling was always interesting because it's quite a specialised sort of area.	RQ2; RQ3A2; RQ3A2	RQ3A2 MAP									Company J2 were highly particular about the material they used As Company J2 were a large company they used to dictate terms to Company H2.		1 **Ability, Reliability, Integrity**	Company J2 would dictate what material they wanted Company H2 to used to leave tooling issues to Company H2.	Company H2 were nervous of Company J2 due to their purchasing power.	Identifying progression tool manufacturers was difficult as it is quite a specialised area.	**Confidence, Ability**	
Participant	Er it was fairly…it was small components but it was generally…	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	Progression tooling, yeah.	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	Yeah, and that was more often than not through word of mouth a lot of times. Erm speaking to competitors or people who you knew in the industry, and getting recommendations then as to who people had used for…because it's quite a specific thing.	RQ3A2; RQ3A2	RQ3A2 MAP		Company H2 identified partners who were noted for using Progression tooling. Company H2 experienced a lot of trouble with progression tooling and spent a long time trying to get it to work.	2 **Ability, Credibility, Judgment**	Company H2 identified progression tool manufacturers by speaking to competitors and other people in the industry.	Competitors were aware of Company H2 who worked in the same or related industry sectors	Competitors and other notable people supply details of progression tool manufacturers	**Benevolence, Judgement**	Progression tool manufacturers are identified by Company H2.								
Participant	Yeah. Yeah, there is a lot of trouble with it. It's always took a long time to get it working how it needed to work.	RQ3A2	RQ3A2 MAP																
Interviewer	I think, from my experiences, the bigger tooling which used to be quite interesting, but the smaller used to have some really bad times with developing and proving progression tooling.	RQ3A2 (For Ref); RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	You know, and you were making, you're punching out five or seven at a time which are really odd numbers, but they're all nested on…	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	Yeah. Well on coil.	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																
Participant	You know, and we were just rattling them off, thousands of them per hour. But you need to make sure that they're coming out how they should do, because if you get misfeeds and all the rest of that is the tooling and then yeah.	RQ3A2; RQ3A2	RQ3A2 MAP		Company H2 produced thousands of components per hour using progression tooling and would occasionally get misdeeds caused by issues with the tooling.														
Participant	So there was a…people were often quite nervous in finding new suppliers, and then there was an awful lot of development to be done with them. But yeah, more often than not it was through word of mouth recommendations from other people within the industry.	RQ1; RQ3A2; RQ3A2	RQ3A2 MAP																
Participant	That was Company H2.	RQ3A2 (For Ref)	RQ3A2 MAP (For Ref)																

KEY:

Green Text: Trust Antecdents and Trust Descendents

Blue Box: Explicit Practice
Blue Test: Tacit Practice

Red Box: Explicit Procedural Knowledge
Red Text: Tacit Procedural Knowledge

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Company H2 were nervous in finding new progression tool manufacturers due to Company J2's purchasing power and the amount of development work that would be required.

RQ3A2 MAP

Table F1 SME Sub-Group Narrative Map for Relationship Formation Phase (Case Study Six)

	Response:	RQ No:	Map Filter	Behaviour (TA) (Large Co)	Action (Large Co):	Trust Antecedent (Large Co)	PKS (What/How) (Large Co):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):
Participant	Erm yeah. I would say the…another example is in the balanced score card that is used in Company O1 for suppliers. So, the balanced score card is used to assess all the deliveries that a supplier has made in a month. Erm it looks at whether they were delivered on time, whether there were any quality defects, and whether there were any concessions. And a concession, erm I'm sure you know what it is, but when I'm talking about a concession I mean something that is not as per the standard drawing but we think it will still be fit for purpose.	RQ3A3	RQ3A3 MAP	Company O1 used a balanced bcorecard to assess the performance of its suppliers on a monthly basis.	Company O1 assessed the performance based on delivery time, number of quality defects and number of concessions.										
Participant	Yeah. So those, in aerospace, those really are a nightmare because the amount of paperwork and justification that has to be done around a concession, it can be hundreds of hours for some big components. And of course once the supplier knows that they can get away with it once, it's really difficult to close that door again and they'll just assume that they'll always get a concession. So that balanced score card is the way that you rank the suppliers and you measure improvement for the suppliers. And although they don't get any financial benefits for having a good score or a not so good score, the fundamental lever is that the purchasing team only want to source new work through suppliers that have got a really good balanced score card.	RQ2, RQ3A3	RQ3A3 MAP	It is common knowledge in Company O1 that suppliers may take advantage of getting approval for supplying concessed parts.	The purchasing team in Company O1 source new work based on the good scores produced in the balanced scorecard.	1 **Ability, Confidence**	For suppliers with good scores the purchasing team would inform the supplier companies and continue to source the work from them. Suppliers with low scores may be considered as candidates for being reallocated to a different supplier.	Supplier companies are happy that they have been asked to continue supplying parts.	Supplier companies continue making parts to their agreed contractual arrangements.	**Ability, Integrity**					
Participant	So that, erm that's got some quite big repercussions in contractual negotiation because it means that you can't guarantee what work a supplier will get, because it all depends on how well they do.	RQ2, RQ3A3	RQ3A3 MAP	Sourcing work based on good balanced scorecard results can have big repercussions on contractual negotiation.											
Participant	And sometimes, erm we'll push components onto the supplier at the last minute and we'll say yeah, we know that you wanted more time to do this and we know that we haven't totally given you the manufacturing specification yet, but could you just do this and get us out of a hole. And the supplier says yeah, sure, we'll help you out with that. And then maybe they have to get a concession on it at the end because they did it in a rush and we didn't give them much time. And then they get penalised on that. So maybe they don't win the next order because that favour that they did for us has actually counted against them. And in the supplier score cards that we use, it's a data driven score card so it's looking at number of concessions, number of defects, number of late deliveries. The fact that you helped us out at short notice, you know, that sort of behavioural soft erm aspect, that does not…that is not worth a jot when it comes to, you know, 12 months down the road and we're looking at who to reward this new contract to. So, I guess, the issue that that raises is can you really just use a data rational objective method of appraising your suppliers and ranking them, or do you actually need to bring on board things like their erm sense of urgency and their agility and their willingness to help solve a problem, regardless of who's caused the problem. All those soft skills in most industries are really, really important, and they can, particularly in a high technology, high complexity product, they can make the difference between Company O1 succeeding and failing when they're trying to get, say, a new engine on an Company V1 plane or something.	RQ2: RQ3A3, RQ1,	RQ3A3 MAP	Company O1 are aware that a supplier company will get penalised for producing concessed parts and may not get the next order as a result	Infrequently, Company O1 will identify the need to use non-standard parts that may be required urgently. For such components to be used a concession would have to be approved in advance.	2 **Empathy, Integrity, Ability**	Company O1 would share the specification of the non-standard part to the supplier company and ask them to make it.	The supplier company is happy to help Company O1.	The supplier company manufactures the concessed parts at short notice.	**Empathy, Ability, Integrity**	Non-standard concessed parts are manufactured and supplied. The supplier company may loose their next order due to supplying concessed parts.				
Interviewer	No, it is. It is a good example. Actually I was going to ask you about erm when there has been a concessed part used, erm when it's been…and the supplier's gone through that process of doing something in an urgent way for you and then they've been given, erm when they've been assessed second time round, they found they haven't got a contract, just purely on the basis of being doing something that was concessed. They find out that perhaps, you know, they wouldn't be too keen to do it the second time around. Has that been the case or…?	RQ3A3	RQ3A3 MAP	Company O1 may well be aware that if they approach a supplier company a second time after loosing an order the supplier company may not be keen to do the work.											

KEY:
Green Text: Trust Antecedents and Trust Descendents

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Blue Test: Tacit Practice

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Red Text: Tacit Procedural Knowledge

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Table F2 Large Company Sub-Group Narrative Map for Relationship Formation Phase (Case Study Four)

	Response:	RQ No:	MAP FILTER	Behaviour (TA) (SME)	Action (SME):	Trust Antecedent (SME)	PKS (What/How) (SME):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (SME):	Trust Action (SME):	Trust Descendent (SME)	Outcome
Participant	Erm certainly on the stuff that I do it's, you know, it's…yeah. Erm previously there was…there used to be quite a lot of negotiations, you know, when I was working at Company H2. Pressings and like I say, our main customer was an automotive customer, so that was a lot more involved and there was a lot more negotiating then. Erm so we would have annual, more or less, annual negotiations on cost increases or decreases. Obviously they would want the cost downs and we would want to put the costs up, which is generally the way it goes as a supplier and a customer.	RQ3B2; RQ3B2; RQ1;	RQ3B2 MAP		Whilst at Company H2, Frank and the his MD were involved in annual negotiations on costs with an automotive customer.	1 Judgement, Confidence	Generally Company H2 wanted to increase the service costs.					The customer wanted to keep their costs as low as possible.		2 Fairness, Confidence	The customer negotiated to keep service costs as low as possible				
Participant	Erm so more often than not it was myself and my MD and then their main buyer and their operations manager or whatever he was, and been from that site, and we would sit down and look at the specifics and really then go through the numbers of overheads, you know, raw material costs, labour costs. Erm we would argue a case for why we needed to put the prices up, and they would try and minimise that as much as possible. But that was a lot more involved because we'd also look at things like logistics and other services that we would have provided, because we were doing Kanban deliveries and all of that kind of stuff as well.	RQ3B2; RQ1; RQ3B2; RQ3B2;	RQ3B2 MAP			3 Credibility, Judgement	During the negotiations, Frank would go through the numbers related to overheads, material costs and labour costs, logistics. Company H2 would also argue the case for putting up the costs as much as possible.											
Participant	Erm so then it was a lot more in depth and a lot of toing and froing as to how we can make improvements one way or another to benefit both people, both parties.	RQ1; RQ3B2	RQ3B2 MAP	Company H2 are mindful that their analysis should be fair		6 Fairness, Judgement	During the negotiations, Company H2 outlined the changes to their costs and benefits.					The customer realised that Company H2 had to cover their annual costs and if Company H2 produced substantive benefits they were willing to compromise		7 Judgment, Fairness	The customer queried the benefits put forward by Company H2 and was happier with their proposition				The Annual Costs are agreed between Company H2 and the customer.
Participant	The manager of their site would initially just say no, we're not accepting anything, and then you have to then go back with a proposal where, you know, you're still going to be asking for something but you've got to give some benefits. Yes, we're going to put your prices, but while we're doing that we're also going to do this, this and this which will then make your life easier and you'll see some cost savings as a result. So that's…	RQ1; RQ3B2; RQ1; RQ3B2;	RQ3B2 MAP											4 Confidence, Judgement Fairness	The Customer's Site Manager initially would not accept anything put to him, while considering each of the costs put forward by Company H2.				
			RQ3B2 MAP											5 Judgement Fairness	The customer accepted that there would be increases in the areas outlined by Company H2, but wanted to see some cost savings that would benefit them.	In response, Company H2 would be forced to go away and identify cost savings that would to some extent offset the increases.	Judgment, Fairness	
Interviewer	Ah right. Did your customers pay for the tooling? Was it their tooling or was it your tooling which you costed into the price of the products?	RQ3B2 (For Ref)	RQ3B2 MAP (For Ref)																
Participant	They would generally buy the tool and…	RQ3B2	RQ3B2 MAP						The customer would generally buy the tooling.										
Interviewer	So you'll be running their tooling?	RQ3B2 (For Ref)	RQ3B2 MAP (For Ref)																
Participant	Yes. Yeah.	RQ3B2	RQ3B2 MAP		Company H2 was running the tooling														
Participant	It depends. Different customers had different ways of working, but with that customer specifically yeah, they would pay for the tooling.	RQ3B2; RQ3B2	RQ3B2 MAP																
Participant	But there were no…the way we would normally work it was we would only charge them 70 per cent of the tooling and we would maintain a certain proportion of the cost of that tooling because there would then be ongoing work that we would do on the tooling. So while it wasn't theirs completely they paid for the bulk of it but we then kept a part of it which we'd costed into the unit price and all the rest, because it would need for general upkeep and general maintenance. So it was mostly theirs but partly ours.	RQ3B2; RQ3B2; RQ3B2	RQ3B2 MAP			8 Fairness, Judgement	During the negotiation it was agreed that Company H2 would charge the customer 70% of the tooling cost. This was costed into the unit cost of each product. A small proportion of the tooling was owned by Company H2 due to the ongoing running costs. This arrangement would usually be agreed with the customer.											
Interviewer	That scenario can create some really…a bit of, can I say it for the tape, argie bargie.	RQ3B2 (For Ref)	RQ3B2 MAP (For Ref)																
Participant	It could. Because if they were to leave, and take the tooling elsewhere…	RQ3B2	RQ3B2 MAP					This arrangement on tooling invariably caused conflict with customers .	Customers may want to take their tooling elsewhere if they're not happy with the working arrangements. In such cases if the customer wanted to take the tools Company H2 may ask the customer to pay the remaining 30% of the tooling cost.	Judgment, Fairness									
Participant	…then it gets complicated. And that's the reason why we did it like that, was because…and yes, you're right, there's always going to be a bit of conflict over that. But if they decided no, we've had enough of you we're going to take all those tools and take them elsewhere we would then say well, you need to pay us the 30 per cent for all of these tools to then release them.	RQ3B2; RQ3B2	RQ3B2 MAP					Frank acknowledges that the arrangement for recovering tooling costs has caused conflict		Judgment, Fairness									
Interviewer	And have you ever been in a scenario where erm where people have wanted the tooling and then there's been a dispute about how much they should pay?	RQ3B2 (For Ref)	RQ3B2 MAP (For Ref)																
Participant	Very occasionally.	RQ3B2	RQ3B2 MAP						Frank acknowledges that there has often been cases where the Customer has disputed how much they should pay for the tools before wanting to take ownership of them.										
Participant	It would happen but very rarely. More often than not once people have laid down the tool and it's been there for a long time and they don't think twice about it. Once you've had it for 10, 15 years it's more or less forgotten.	RQ3B2	RQ3B2 MAP								In the case where tooling has been running for a longer period of time there has been no issues raised by the customer. Frank comments that the customer may well have forgotten about the tools after 10 or 15 years.									
			RQ3B2 MAP																

KEY:

Green Text: Trust Antecdents and Trust Descendents

Blue Box: Explicit Practice
Blue Test: Tacit Practice

Red Box: Explicit Procedural Knowledge
Red Text: Tacit Procedural Knowledge

TA: Trust Antecedent
TD: Trust Descendent

Table F3 SME Sub-Group Narrative Map for Relationship Implementation Phase (Case Study Six)

	Response:	RQ No:	Map Filter	Behaviour (TA) (Large Co)	Action (Large Co):	Trust Antecedent (Large Co)	PKS (What/How) (Large Co):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (Large Co):	Trust Action (Large Co):	Trust Descendent (Large Co)	Outcome
Interviewer	Yes. Okay, that's another good example. Erm moving on to question four, relationship implementation, which relates to contract negotiation and development, your second example was development of a technical administration costs from a third party onsite outsource provider.	RQ3B1	RQ3B1 MAP (For Ref)																
Interviewer	Could you tell me a little bit more about that?	RQ3B1	RQ3B1 MAP (For Ref)																
Participant	Yeah. So this is erm this was an organisation called Company S2, and the problem that I was trying to solve was that although in Company O1 functionally I had something like 2,200 manufacturing engineers around the world, the workload equated to about 2,800. So the obvious thing to do is to recruit 600 more engineers. But you have two problems there. Number one, the engineers with those skills are not just sat around on shelves waiting for me to ring them up. And number two, it's very expensive. So the analysis we did of what that engineer was actually doing was very revealing, because to use a simple analogy, either you or I could go home tonight and make a reasonable job of cooking a spaghetti bolognaise. And the reason for that is that the hypothesis, the experimentation, has already been done by a chef. They've then written out the recipe on a recipe card and as long as we follow that recipe we've got every chance of success. So what we found when we looked in detail at what Company O1 engineers were doing, is we had engineer who had got the capability to do design and hypothesis and experimentation work who were actually just turning the handle and doing standard tasks. So by extracting out the standard tasks, we were able to bring in an onsite outsourced partner. And what that means is they erm float around the site, you would imagine that they worked for Company O1, but actually they don't. So it's the sort of thing that say in a university you've got site services, or your catering is being done by an outsourced partner.	RQ1, RQ3B1	RQ3B1 MAP	Derek is aware that not all engineers' skills are readily available to pick up of the shelf. Such skills are also quite expensive to acquire.	Whilst working at Company O1, Derek did an workload assessment on a global scale and found that he required around an additional 600 engineers. A detailed study was done of the Company O1's business processes and it was decided to outsource some of the standard tasks to an Engineering Services provider.	Ability,, Honesty												
Participant	So the contractual issue that we had there was that supplier wanted to say well, how many resources do you need? Do you need 10 people, do you need 30 people, and actually what we wanted was we needed the right amount of resource, whatever that was for any day in the week, for any week in the year, so we needed that supplier not only to provide us with the resource, but to work out the right amount of resource as well.	RQ3B1	RQ3B1 MAP		Company O1 commissioned the services of Company S2 to supply engineers as and when required.. Co O1 drafted an outline contract covering the service areas.	1 Ability, Credibility	Company O1 engages with Company S2 to agree the service areas to be covered and outline the more specific details of the contract.					Company S2 is aware of the broad terms of the contract , but needs clarity as to what is required of them.		2 Ability, Honesty	Company S2 need to know specifically what level of resource is required and when.				
Participant	And contractually that was very difficult because they wanted guarantees about the minimum amount that…and first they wanted a guarantee that they would be paid for all the time that they had people on site. But then as we matured the model, and paid by deliverable, we said well we're only going to pay you for things that you do, and it's up to you to decide how many people you need on site to make sure that you can be responsive enough to do the tasks that we need in the time that we need them to be done.	RQ3B1	RQ3B1 MAP		Initially, Company O1 did not know what the optimum level of resource was. Based on Company S2's initial quotations, Company O1 was able to determine a minimum cost for each service area.	3 Honesty, Judgement	Company O1 wanted Company S2 to determine the minimum level of resource for each service area through experience of delivering the services on site at Company O1.					Company S2 initially are nervous that it would not have enough staff to cover the work on site at Company O1		4 Honesty, Judgement	Initially Company S2 wanted a guarantee that its personnel would be paid for the time spent on site.				
		RQ3B1	RQ3B1 MAP		Company O1 (in conjunction with Company S2), oversee operations. Through time, they both see the level of uncertainty reduce.	5 Honesty, Judgment	Company O1 and S2 agree that as the model had matured, Company O1 wanted to pay buy deliverable and leave it up to Company S2 how much resource they have on site.				The Contractual arrangements are updated to reflect their current activities. Engineering services are provide by Company S2 by deliverable to Company O1's requirements.	Given their experience, Company S2 feel more comfortable about the project.		6 Confidence, Reliability	Company S2 discuss and agree to the arrangements outlined by Company O1.				
Participant	Now that is a sort of risk and revenue sharing arrangement. So I'll give you an example of a typical task. A typical task might be to collect the…erm collect some samples from the shop floor to package them up, send them off to an NDT, non-destructive testing lab, wait for the results, get the results, produce a summary of the results, present that to the manufacturing leader, and then put the components into the archive. So there's maybe 10 steps there. Erm I would expect you to be able to do all of that for say 30 pounds.	RQ3B1	RQ3B1 MAP				Derek described the above activities as a type of risk and revenue sharing arrangement. (Note: This arrangement is used for the supply of products)												
Participant	And so we'd start at the 30 pounds and that would be agreed. If you get really, really good at that and you can do it in 10 minutes, I'm not bothered, you'll still get the 30 pounds.	RQ3B1	RQ3B1 MAP (For Ref)																
Participant	Erm but the issue seemed to come in the supplier seemed to think that if they did get really good and really slick at it then I'd refuse to pay them 30 pounds.	RQ3B1	RQ3B1 MAP									In the early stages, Company S2 thought that as they got more efficient Company O1 would not pay them the going rate.	As Company S2's understanding of the Company O1's process developed, they became more efficient at delivering their services.	7 Honesty, Judgment	Company S2 update Company O1 on their progress and indicate their reluctance to be paid less than the going rate.				
Participant	But I'm not bothered, because compared to how much I was paying my Company O1 engineer, you know, it was costing me way more than that. But getting the supplier's trust that I wasn't going to baseline the price or anything, and that any improvement they did was money in their pocket. That was far harder than I expected it would be.	RQ3B1	RQ3B1 MAP	Derek confirmed that it was harder than he expected to get Company S2 on-board with the arrangements.		8 Honesty,, Judgement	Company O1 told Company S2 of their intention to not baseline the prices and any improvement was money in their pocket.	Company S2 needed to see the service model working for a period of time before signalling their content to Company O1.		Honesty, Judgement	Company O1, honour their agreement by continuing to pay Company S2 for the services delivered over the respective time frame.							
Interviewer	Yeah, that's quite interesting. How long did it take, actually, out of interest would you say? What length of time?	RQ3B1	RQ3B1 MAP (For Ref)																
Participant	Erm over six months it took before we got what we'd call a service catalogue running; that is you got standard deliverables in the catalogue with a standard price and a standard lead time.	RQ3B1	RQ3B1 MAP																A Service Catalogue was set up and running with standard deliverables, prices and lead times.
Participant	But it drives, it does quite a good behaviour because, I mean, so either like getting your bins collected, getting your dustbins emptied, because dustbin men, they've tendered a certain number of bins for a certain amount of money. Yeah.	RQ1, RQ3B1	RQ3B1 MAP (For Ref)																
Participant	And people don't always understand that, and supposing they don't put their bins out to be emptied or it's got the wrong type of waste in it, they think the dustbin man is being unreasonable when they say well I can't collect that. And of course this dustbin man isn't just a general council worker, he'll be working on a contract that's been contracted against specific conditions. So, the benefit it had to us in Company O1 was that it drove our behaviours to make sure, in the example that I gave you, that those components were all in the right place on the shop floor so that the person could come and pick them up and send them off to the non-destructive testing lab, and all that sort of thing. So cataloguing and moving to a standardised sort of standardised service, is really beneficial for everybody.	RQ1, RQ2	RQ3B1 MAP																Development of the Service Catalogue had a positive affect on the organisation of Company O1's working practices.

KEY:
Green Text: Trust Antecedents and Trust Descendents

Blue Box: Explicit Practice
Blue Test: Tacit Practice

Red Box: Explicit Procedural Knowledge
Red Text: Tacit Procedural Knowledge

TA: Trust Antecedent
TD: Trust Descendent

RQ3B1 MAP (For Ref)

Table F4 Large Company Sub-Group Narrative Map for Relationship Implementation Phase (Case Study Four)

	Response	RQ No:	Map Filter	Behaviour (TA) (SME)	Action (SME):	Trust Antecedent (SME)	PKS (What/How) (SME):	Behavour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecdent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (SME):	Trust Action (SME):	Trust Descendent (SME)	Outcome
Participant	So for the wheelchair that I was making I needed a special tyre commissioning. And I used a Rapid Prototyping House for that, and it was experimental work. We didn't really know how to do it. So I went down, had a meeting with them, discussed it, came up with a method to do it. I did some sums for them to work out the right geometry that we wanted and they made the part. I struggled a little bit with it because I had something in mind, and I kept having phone calls with them and it didn't…couldn't get it across between each other over the phone. It took a meeting face-to-face to get that. Basically I didn't want…I wanted to use a vacuum cast process to cast a tyre onto a hub so I could cast it in one continual lump of rubber. They didn't want to do a vacuum cast tool with the motor in place because the vacuum cast tool also has to be made under a vacuum which I hadn't realised.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP		Brian is aware in broad terms of what he requires and the methods that could be used. Brian considers a number of companies and decides to pick a local RP Company based on their expertise.	1 Ability, Credibility	Brian has a number of phone conversations with the RP Company and struggles to outline his requirements.	The RP House was willing to listen to Brian.	The RP Company begins drafting the quotation for Brian's job.	Empathy, Honesty, Ability,	Co O's requirements are not fully understood by the RP House							
		RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP			2 Ability, Credibility	To gain a more detailed understanding, Brian arranges a face to face meeting with the RP Company to describe his requirements in detail.	The RP House was willing to listen to Brian.	The RP Company continued to develop the estimate cost of the tooling	Empathy, Honesty, Ability,		The RP Company respect Brian's requirements but want to outline what the vacuum vasting process can do		4 Empathy, Judgement, Honesty	When the RP Company learned that a motor was near to the hub they told Brian that he would have to consider changing the motor or various ways of modifying the tyre.	Brian respected the view of the RP Company given the requirement of the Vacuum Cast Process.	Brian considered different options to changing his design	Empathy, Honesty, Judgement	The wheelchair design is corrected so that the tyre can be vacuum cast on the hub.
Participant	I knew the vacuum casting process was under a vacuum, I hadn't realised the tool was also done under a vacuum.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP			5 Empathy, Ability	Brian informs the RP House that when Vacuum Casting he didn't realise that the tool was also put under a vacuum.												
Participant	And they were worried that some of the silicone would go inside the motors and things and would cause problems.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP											6 Empathy, Judgement, Honesty	The RP Company was concerned that some of the silicone would go inside the motors and this would cause problems. They therefore ask if Brian would consider modifying the geomtery of the tyre.				
Interviewer	Right, okay. So you would, getting back to the question about outcomes, so you would say it depends obviously on the nature of the product and the nature of the business, as to where you…how you tackle your contracts. But generally in where you've worked the more specialised the case obviously the more upfront negotiation that's required, the more open the arrangement. So in that case, where you were getting your 3D printing work done did you have a…did you sign? Did you get something signed late after it was all done, basically?	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	I suppose it was probably fairly loose and upfront. We sent them the files and they send back a quote and say yeah, we'll make those for you and it will cost you that much.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP		Given the nature of the work Company O's project brief was kept quite open at the start.	Ability, Credibility	Company send the RP House the Project Brief and ask them to provide them with a quotation for the work.		The RP House prepares the quotation for the work.	Ability, Benevolence	One completed quotation is sent to Company O to cast the wheel chair tyres.								
Participant	But that's because we've got a bit of a history I know what they've done for me in the past. I know what they can do, I don't really need to go and speak to them about every single job.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	Brian has asked the RP House to do work in the past and therefore he has some idea of the capability of the company in question.				The RP House has done work for Company O in the past and therefore they know of them and their products.											
Participant	It's easy then. But at the point when you've got a blank sheet of paper you've just got to try and make sure that I think…and I think going through the process of writing it down and explaining it to people saying this is the reasons why I'm going to pick this. It should be okay. Done some sums and it looks like it will be all right, but there's some uncertainties, we don't really know about whatever it might be. So on the wheelchair I was worried about the power, the start-up torque.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP			Judgment, Ability	Brian explains that in most Designs, once the calculations have been done the basis for key parameters can be explained and uncertainties identified. In the case of this project, Brian's concern was the power and start-up torque required for the unit to move smoothly. Given the very high start-up torque required, Brian explained to the RP Company that whilst a heavy gearbox would be ideal, it would also be very costly.										
Participant	Now yes I could specify a motor with enough start-up torque but it will be masssive, and we want weight as equally a consideration. So and cost, you know and the bigger the gearbox the more the cost, the more the weight. I didn't really want to drive it too far, and once you've got a solution that works it's then not necessarily easy to come back and specify something less. So we took the…I explained all of this and I think that's been okay. I'm struggling a little bit with some thicker carpets.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP			Judgment, Ability													
Participant	So yeah, we need to change the spec a little bit for the next version. There you go. That's why you make a prototype to try and…	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Brian acknowledges that the wheelchair specification needs to be changed a little bit for the next version.								

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RQ3C2, RQ3C2 TPK MAP

Table F5 SME Sub-Group Narrative Map for Relationship Evolution Phase (Case Study Two)

	Response:	RQ No:	Map Filter	Behaviour (TA) (SME)	Action (SME):	Trust Antecedent (SME)	PKS (What/How) (SME):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behaviour (TD) (SME):	Trust Action (SME):	Trust Descendent (SME)	Outcome
Interviewer	Yeah. Yeah. Okay, that's quite interesting. Erm okay, that takes care of that one. The next, that was question three, the next section is stories or anecdotes related to tacit knowledge. Erm I've said tacit knowledge in this project relates to knowledge in the form of personal experience erm that has only been known to you prior to sharing them in various scenarios which I would like you to give us some examples of. This is question four. I've chose the wheelchair examples. Again, you said you commissioned that with a rapid prototyping company to vacuum cast the tyre. It was mentioned that you struggled to work out the geometry of the tyre, I think it was, and you had an initial period where you erm where you tried to do that and you tried to discuss it over the phone with a supplier.	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP	Brian commissioned a Rapid Prototyping company to produce a Tyre for the Wheelchair that he was designing.	Brian needed a special tyre making for a wheelchair.	Ability, Judgment	Brian struggled to work out the geometry of the tyre and as a consequence struggled to outline his requirements to the RP company over the phone.											
Participant	I suppose with reflection there was probably misplaced tacit knowledge, almost, because I had in mind how I would have done it and discussed it over the phone with them, and they kind of agreed but had a slightly different method of how they were going to do it.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				Brian declares that there was some "misplaced tacit knowledge" because what he had in mind and discussed over the phone was slighty different to what both parties agreed later.	The RP Company demonstrated their willingness to listen to Brian by understanding his design requirements.									
Participant	Yeah. It was really what model do they want, how do they want to cast it and how do they want it assembled and bonded in place. And I think the reality was it ended up being slightly different in practice as well.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				Both parties discussed the solid model of the tyre, how to cast it, and the way in which tyre would be assembled and bonded in place.											
Participant	Certainly I...I'd imagined initially fastening it in one piece.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				Brian's thoughts were centred on the premise that he wanted to cast the tyre in one piece.											
Participant	For a vacuum casting process, the fact that it's in a vacuum means that all of the silicone would have probably got sucked into the internals of the motor at some point, or it was a risk erm which I hadn't quite taken on board and that hopefully we could have got around that, you know, erm with some kind of sealings or something, you know. Er you can put clingfilm inside of it for instance.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				Brian didn't realise that the silicone would sucked into the internals of the motor due to its position and the fact that it was done in a vacuum. When confronted with this issue Brian thought he could use clingfilm as a barrier positioned approximately.											
Participant	And er make false barriers and things, so I'd kind of imagined doing something like that. But they weren't particularly keen on that. Erm....	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP					The RP Company were not keen to use clingfilm as a barrier.										
Participant	Yeah. I mean, it was actually a project for the university. I did erm it was a piece of breathing apparatus. Because both times they wanted like an adaptor to go from a regulator onto essentially a hose erm which I modelled up for them and within that I wanted to have a pin to locate onto something but didn't want any breaks in it to er let the air out. So there was er a bit like an internal feature in this tube.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				Brian recalls a university project where a piece of breathing apparatus (regulator) made from silicone was designed with a metal pin within it as an internal feature.											
Participant	You know. It could be rapid prototyped no problem at all, but we wanted a few of them and we wanted it vacuum cast. So they rapid prototyped it and put a piece of, it was clingfilm, some kind of barrier in there, cast the silicone so when the silicone came apart it formed a two part line internally.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				The regulator was rapid prototyped, a die was made from the part with a pin covered with clingfilm as a barrier enabling silicone to be cast around it.											
Participant	And that seemed to work quite nicely.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP				The parts produced from the university project worked.											
Interviewer	But this other company just didn't like the idea. They obviously would have known what you can and can't...known what....	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP			**Ability, Judgement**	Brian suggested using a barrier in the wheelchair project.	The RP Company didn't like the idea of using a barrier to Vacuum cast the tyre.	The RP company carefully considered Brian design requirements.	**Integrity, Honesty, Ability**								
Participant	Yes. They were absolutely right actually. But it did take a while just to get erm full agreement from myself and for them to be able to do the job as well.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Brian comments that it took a while to agree on the approach (design and manufacturing process) to be adopted.								
Interviewer	Erm so how did you get around that part that you were referring to?	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	Erm I took the...I took the motor down because see they were doing it without being able to see the motor, and I was doing it without them manufacturing knowhow. So I took the motor down to them and we discussed it and came to a solution.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	Brian was determined to reach a solution to his problem of how best to Vacuum Cast the wheelchair tyre.	When going to discuss the issue with the RP Company, Brian decided to take the wheelchair motor with him	**3** **Empathy, Ability, Integrity**	By showing the RP Company the motor Brian hoped they could apply their manufacturing knowhow to come up with a solution.											
Interviewer	Ah right. Okay. So they didn't know about...they took a look at the motor, which was obviously near where the tyre was going to be.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP					The RP Company better understands Brian's requirements	The RP Company inspect the wheelchair axle assembly and take measurements of various aspects of it.	**Empathy, Ability, Integrity**								
Participant	Well, one of the other problems with that, there was a risk of the silicone going inside the motor, but also the tool would have to be that bit bigger, so the additional cost and we only wanted to try it. So the cost effective way that we came up with was just to cast the tyre as a c-shape, if you like. So rather than it being a full tyre there was a little gap and that the tool could be smaller but it had to be bonded. So I generous...I measured it, I measured the hub, erm worked out what the circumference was, rounded it up just a little bit.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								When considering the dimensions of the wheelchair assembly, a solution derived by both parties was to cast the wheelchair tyre in a c-shape.	**7** The RP Company were happy that a solution was identified with Brian.	The RP Company were able to start design work on the tooling for the job.	**Ability, Honesty, Integrity**				
Participant	And then increased the diameter so that it was actually slightly open. Only by, you know, a few millimetres.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP													Brian was happy with identifying a solution in the form of a C-shape tyre.	Brian re-designed the solid model of the tyre so that its external diameter was slightly open by a few millimetres. **Ability, Integrity**	A viable wheelchair tyre design that could be vacuum cast to produce a good fit on the wheelchair assembly
Participant	Well opening...well opening it up on the diameter meant that I could add a little bit to the length of it in case of any shrinkages, because if it ended up being too short you'd have a gap in your tyre.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP												By opening up the tyre diameter the RP Company advised that additional length could be added to accommodate for shrinkages.				
Participant	And then get a vacuum casting off that. Off the trimmed version.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP												A wheel was rapid prototyped that was used to produce an impression for the die cavity. The wheel was then vacuum cast in position on the axle.				
Participant	Yeah. So it let us do a little bit of manipulation of it.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP												By taking the suggested approach the RP Company outlined that this enabled them to adjust the size of the Tyre to get the best fit possible.				
Interviewer	Right. Okay. Erm that...that takes care of that one, I believe. Just to ask a question when winding back a little bit, when you asked about using some kind of erm polyethylene or whatever to, you know, to get around when you were explaining what you wanted to do, were they sort of quite aghasted or did they...were they okay with it or did these...?	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	...they get approached with erm all sorts of weird and wonderful projects anyway, so they seemed to be fairly open to new ideas and suggestions.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP					The RP Company appeared to be fairly open to the idea of using a clingfilm barrier when vacuum casting the wheelchair tyre.										
Participant	It's very difficult because you remember things differently to how they happened. It's quite difficult recalling all of this.	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	Especially with tacit knowledge. They know exactly how things get made, and they are experts in their own individual process, and in a design that you can't be an expert in all of the processes.	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	You've got to go and see first-hand how it's made, I think. Well, that's my experiences, anyway, that, you know, speaking to a fabricator, speaking to the guy in the machine shop, whatever it is, there's always tiny little gems of information that they bring out that you wouldn't really think of.	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Participant	And then you can get cost reductions from doing that.	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK MAP (For Ref) RQ3C2, RQ3C2 TPK MAP (For Ref)																

KEY:
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Blue Test: Tacit Practice

Red Box: Explicit Procedural Knowledge
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TD: Trust Descendent

Table F6 SME Sub-Group Narrative Map for Relationship Evolution Phase (Case Study Two) (Follow Up)

Response:	RQ No:	Map Filter	Behaviour (TA) (Large Co)	Action (Large Co):	Trust Antecedent (Large Co)	PKS (What/How) (Large Co):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (Large Co):	Trust Action (Large Co):	Trust Descendent (Large Co)	Outcome
Erm I think it's not a brilliant example, but I would say in submarines the team of quality engineers that worked for me were spread across the whole spectrum of reactor plant technology. And so when I left, the most difficult thing I used to do was schedule erm engineers for what you call inspection points, so we don't just wait for you to ship the product, we'll go out and see how you're getting on and we'll inspect at different levels of erm manufacture. Now, the tricky thing there is that you need to assess the supplier's capability, know how much you can trust them, basically.	RQ2, RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	At Company O1, Derek managed a team of Quality Engineers who worked across the whole spectrum of reactor plant technology.	One of Derek's main task was to devise a schedule for engineers to inspect the systems used by supplier companies who produce reactor plant parts.	1 Ability, Honesty, Integrity	Company O1 Quality Engineers assessed a supplier's manufacturing processes.					Each Supplier Company are happy to be assessed by the Quality Engineer.		2 Honesty, Integrity, Judgement	The Supplier Company demonstrates their working practices to the Quality Engineer from Company O1.				The capability of the Supplier's reactor plant manufacturing processes is established and recorded.
Look at the technology involved. Look at the geography of where that factory is and then try and triangulate between the three and pick the engineer that is most appropriate for that erm for that supplier.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP		Derek decided to devise a schedule to conduct the audits, he would look at the technology developed, the geographical location of Company O1 and location of the Supplier and triangulate between the three. An engineer would then be chosen based on the assessment.														
And it took me 12 months to get really good at that because you realised that although you'd think that you'd just keep sending the same engineer to the same place because they know that component and they know that supplier, that familiarity is what creates blind spots in surveillance regimes. So you have to keep erm keep shaking up the pack a little bit, or shuffling the pack, to make sure that a new engineer comes along who will not take things for granted, and who will really dig under the surface of what that supplier is doing.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	Derek became aware that as the same engineer keep going to a particular Supplier their familiarity creates blind spots in a Supplier's working practices.	Derek reallocated engineers who had developed too much trust with a Supplier to ensure that they do not over look any items.														
What do you mean by a blind spot? Is that where people come overtly familiar? Erm and think…	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP (For Ref)																
It's where erm you assume too much about the supplier, so you've seen them do something once and it was okay so you don't bother checking the next time because you think that they will do it again.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP (For Ref)																
They'll always have done that okay. So somebody with too much knowledge can become over familiar and that's where you get the blind spots. You have to…you need the mindset where you assume that what that supplier has made is incorrect until you convince yourself that it is correct.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP		An Engineer with too much knowledge becomes over familiar, which creates the blind spots.														
But it's hard for those engineers because they build up a personal rapport with the people in the supplier.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	It gets hard for the Engineers because they build a personal rapport with the Supplier															
And when…if, you know, if you say to me yeah, it's been heat treated and then erm assembled correctly, and I have to say well okay, you've said that but I would like you to disassemble it now. I just want you to show me the heat treatment record. You'd think what's the matter with me? He doesn't trust me.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP (For Ref)																
And actually no, I don't trust you. I'm not paid to trust you. I'm paid to validate every aspect of what you've done. So…	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	Derek believed that the mindset of the Engineer should be that they do not trust the Supplier and should validate every aspect of their systems.															
Oh yeah. Yeah. So erm you…because when I started in that team I thought the best way to learn it is to go around and see the suppliers and look at the equipment they were providing. So a very good…I mean, this is a very specific example, but erm pumps and valves, they have to be pressure tested, okay.	RRQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP		Derek decided to visit some suppliers and at one particularly company he inspected the Pump equipment they were providing.	3 Ability, Honesty, Integrity	Derek asked the Supplier to show him how they tested the pump.												
And the way that you pressure test it is you hydrostatically pressure test it, so you fill it with water and then you pump pressure through the water to see if you can get the valve to break. Okay.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP									The Supplier was happy to show Derek how they test the Pump..		4 Honesty, Integrity, Judgement	The Supplier showed Derek how the Hydrostatic Test Rig worked with water.				
Now, the normal engineer that has been witnessing that has been witnessing it for, I don't know, probably five to ten years, and my…when I first went and witnessed it I was looking at this testing rig and I realised that they hadn't…with the test rig they wouldn't be able to evacuate all of the air out of the component before they were testing with water. So because air compresses, if it fails with compressed air in it at that pressure you've got a massive release of energy and, you know, that could…it would explode, it will kill somebody. Whereas, when you test just with water, because it's not compressible, you get a slight jolt when the component fails. So, uncovering or exposing that was something that only I was able to do with fresh eyes. Everybody else had just taken it for granted that it hadn't occurred to them in a million years that that would be an issue.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	Derek was aware that the pump test would have been witnessed by Company O1 Quality Engineers for a number of years.	Derek observed the Pump Test Rig.	5 Honesty, Empathy, Integrity	Derek noticed that the Supplier would not be able to evacuate all of the air out of the pump before they tested it with water. He deducted that If the pump failed with compressed air, it would produce a large release of energy, which was dangerous. He passes this observation on to the Supplier.	The Supplier Company was surprised at Derek's observation as the pump had not failed due to the air, which could have been left in the pump prior to being tested with water.	The Supplier assured Derek that the test would be revised to ensure that all air is evacuated from the pump prior to being tested with water.	Honesty, Empathy, Integrity							
Yeah. And was that an experience that you had whilst working at Company O1, yeah?	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP (For Ref)																
Yeah, that's in submarines, yeah.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP (For Ref)																
		RQ3C2, RQ3C2 TPK MAP (For Ref)																

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Red Text: Tacit Procedural Knowledge

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TD: Trust Descendent

Table F7 Large Company Sub-Group Narrative Map for Relationship Evolution Phase (Case Study Four)

	Response:	RQ No:	Map Filter	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (Large Co):	Trust Action (Large Co):	Trust Descendent (Large Co)	Outcome
Interviewer	This is question 15, for the recorder. You mentioned the supplier pump test and what was the outcome from the observation that you made? Did the supplier modify their test procedure to ensure that all the air was evacuated from the pump prior to the water being test? Also, erm did they modify the design of the pump in any way?	RQ3C2, RQ3C2 TPK (For Ref)	RQ3C2, RQ3C2 TPK (For Ref)								
Participant	So they, erm they definitely didn't modify the design of the pump. I can't remember whether it was a pump or a valve but they definitely didn't modify that. Erm I do happen to know that they also did not modify their method of working. So while I was there observing it they modified it and did it safely but they hadn't changed that process since then. They basically did that just to pacify me.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP	The Supplier was mindful that they had to execute the process in a safe manner.		**6** **Honesty, Integrity**	Whilst Derek observed the Supplier using the pump, they modified the process to demonstrate it safely,	Derek felt the Supplier's demonstration was done to pacify him		**Ability (Low), Integrity (Low)**	It was noted that the design of pump or valve was not modified. The Supplier did not modify their method of working.
Participant	No. They didn't. And as it happens, by sheer coincidence, they have identified their erm lack of root cause countermeasure as a systemic issue throughout their organisation. And so they did actually interview me to be their continuous improvement director back in erm December of last year.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								The Supplier had identified their lack of root cause countermeasure as a systemic issue throughout their organisation.
Participant	So I happen to know that that is an issue with that particular supplier but they have recognised it and they're trying to do something about it.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Company O1 had recognised that they had issues with that particular Supplier and they were trying to do something about it.
Interviewer	So it's…so that was just a point in case. So a lot of things were like that, that was something that wasn't being done in a lot of different processes that they were throughout their company, yeah?	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								
Participant	Yeah. Generally what you find is, and this is just in my experience, that generally the companies that have not thought the health and safety implications through are also the companies that haven't bothered doing their production planning particularly diligently.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Derek generally finds that the companies that have not thought the health and safety implications through are also the companies that have not bothered doing their production planning diligently.
Participant	And they're also the ones who don't bother getting to the root cause of their quality escapes.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Derek also aded that such companies are also the ones who do not bother getting to the root cause of their quality escapes.
Participant	That it's just a poor management mindset that they have.	RQ3C2, RQ3C2 TPK	RQ3C2, RQ3C2 TPK MAP								Derek concluded that such companies have a poor management mindset.
			RQ3C2, RQ3C2 TPK MAP								

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Table F8 Large Company Sub-Group Narrative Map for Relationship Evolution Phase (Case Study Four) (Follow Up)

	Response	RQ No:	Map Filter	Behaviour (TA) (SME)	Action (SME):	Trust Antecedent (SME)	PKS (What/How) (SME):	Behavour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecdent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (SME):	Trust Action (SME):	Trust Descendent (SME)	Outcome
Interviewer	Yeah. Okay. Quarter to, I'll have to move on. The last area is related to the end of relationship or the end of the project where basically where people would look back and reflect on what they've done, and there will be an element, a particular aspect of that, would be…and quite a lot of collective reflection, trust and knowledge sharing there. You mentioned that the most important of that will be building a prototype capturing the lessons learnt in order to better understand the design and what you would do in future prototypes. Are there any memorable experiences of where you've actually done any design reviews where people, there's been some really interesting comments made where people have initially been, how can I say, guarded and basically testing the water to see what other people say. Because I usually get…I find it quite strange when people have design reviews and everything went well. And it may be that somebody's not saying anything because they've either learnt something that will do though that's their next career move, if it's something really valuable. Or they've been ignorant to it and they've gave it away and other people haven't, do you know what I'm saying?	RQ3D1 (For Ref)	RQ3D1 MAP (For Ref)															
Participant	Yeah, yeah, certainly oil and gas is a funny industry to be involved with. I wasn't on their discussions but I was part of the team to develop the Company L Product A, which was a new product. And it was to get over some of the difficulties that we foresaw with trenching cables between turbines.	RQ3D1	RQ3D1 MAP (For Ref)	Brian comments that the Oil and Gas Industry is a funny industry to be involved in.															
Participant	So you can't use a plough because if you start pulling it you're probably going to hit one of the other turbines because you're pulling in a straight line. Also, it's not a straight line. There was a forum held and my senior engineer went to it and he said it just ended up being a waste of time because we were looking for what are the difficulties, we wanted the problems to solve, but unfortunately we had multiple cable – what would you call them – the people who trench the cables, multiple companies, and they certainly didn't want to air any of their dirty laundry in public, so the answers came back we don't have any problems. Every job we've ever done was no problem to us. Easy. All perfect. Products are perfect. But from a design review point, that's just no help at all.	RQ3D1	RQ3D1 MAP	A Senior Engineer in Brian's team at Company L originally attended the Forum willing to share lessons learned in a frank and honest manner.	The Senior Engineer in Brian's team attended the Supplier Forum and told Brian about the time in question.	1 Honesty, Benevolence	The Forum Chair from Company L outlined the intended agenda of the forum and outlined potential areas that were to be discussed. The Chair then invited the attendees to provide comments on the lessons learned from each company's perspective.				On the whole nothing was gained from the exercise.			2 Benevolence, Integrity (low)	The other trenching companies commented that they had no problems and everything was perfect.			
		RQ3D1	RQ3D1 MAP	Brian was aware that the task of developing the machine was not straight forward as a number of issues were encountered. For example: Comapny L was aware that the task of ploughing for the Trenching Companies in itself was a difficult operation as it was difficult to do it in a straight line and therefore increased the likelihood of hitting something.															
Participant	But equally, nobody was willing to step and say it would be better if you did this, it would be better if you did that. Nobody would give us that information.	RQ3D1	RQ3D1 MAP					Other representatives (Trenching Companies) weren't willing to share their personal experiences with companies operating within the same market as themselves.											
Interviewer	Yeah, that's quite an interesting one is the fact that you know for a fact there were issues. But they didn't actually come back to you. And it's quite stupid, really, because everybody learns together because if for example they did feed something back, and it could have been only part…and you know for a fact it could only be part of the story and somebody will say yes, I noticed that as well, so if people actually putting in…it's a collective effort.	RQ3D1	RQ3D1 MAP (For Ref)																
Participant	It should have been done on an individual basis rather than as a group.	RQ3D1	RQ3D1 MAP								Company L had the view that the exercise should have been done on an induvial basis and not as a group.								
Participant	Because I think their perception was if I say that we struggle to do the end termination, could you do this with the machine, that the other people in the room would be straight onto the customers going oh I wouldn't touch them, they struggle with their end termination. We don't. So that was a bit difficult.	RQ3D1	RQ3D1 MAP					Company L had the view that some of he Trenching Comapnies thought that Company L struggled with doing end terminations. If this and other issues, were discussed in open forum, the other companies would report this as a weakness to customers.											
			RQ3D1 MAP																

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Table F9 SME Sub-Group Narrative Map for Relationship Conclusion Phase (Case Study Two)

	Response:	RQ No:	Map Filter	Behaviour (TA) (Large Co)	Action (Large Co):	Trust Antecedent (Large Co)	PKS (What/How) (Large Co):	Behaviour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecedent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (Large Co):	Trust Action (Large Co):	Trust Descendent (Large Co)	Outcome
Participant	Yeah. I think erm the example I would use is in submarines, when you…when the customer has a defect, so maybe Company U has an issue which means that the…I mean, submarines always get launched to time plan, but because it's a very, very big thing a submarine launch, but there can be real pressure points where things are just not going well and sometimes Company U will have an issue that spans across a number of different suppliers. So we've made the…Company O1 have designed and manufactured the reactor plant, but they've outsourced some of it, and then another company has fitted it into the submarine, and all Company U knows is that look, this doesn't work. So, you have consortiums of suppliers that have to come together and do the problem-solving in an open and honest way.	RQ1, RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP		Company O1 designed and manufactured a Reactor Plant Assembly and outsourced some parts of it to Company U1. Company U1 with Company O1 then decided to hold a consortium with the relevant suppliers to identify the problem.							Thought time, Company U1 found that they had a quality issue that cut across a number of its suppliers of reactor plant parts.					
		RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP																
Participant	And to start with that is very, very difficult because they'll have commercial people in that organisation saying look, we don't want to accept that we've done anything wrong here, so just be very cagey about everything. But the people, actually, who understand the product, erm they're generally far more open and they're really interested to take part in the problem solving, and they don't get hung up over whose liability it is. So it's like a far more efficient and effective level of communication when you've got people from the different suppliers who may not be all that senior that have all got a common interest in getting to a solution regardless of whose fault it is.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP	Initially, Derek found that the commercial people in some of the Supplier Companies didn't want to admit that they did anything wrong. The Engineers, however wanted to take part in the Consortium.	Company U and O1 identified engineers within the Supplier Companies to take part in the consortium.	4 Honesty, Empathy, Ability		Generally, it is found that people within the Supplier Companies who understood the product weren't hung up on whose liability it was. As a result, those people were more interested in taking part in the Consortium were more open and interested in taking part.									
Participant	So the only reason that we were able, the only reason that we got to that was that this was a really serious issue because if you can't…at this stage the submarine isn't in the water, but if you can't trust your erm temperature sensors on the primary circuit then you can't, you could not run the risk of doing we call power range testing. So you ramp up the reactor to check that it's doing what it's supposed to do. You've got to have total confidence in your measurement system for pressure and temperature.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP				At the Consortium it was explained that the Temperature Sensor could not be fitted properly. As a consequence, Company O1 would not risk doing power range testing where the measurement system is tested at pressure and temperature.											
Participant	Erm yeah, so those occasions are fairly few and far between, but you do then find that knowledge flows absolutely freely between the different organisations. And I think you've got a mutual trust and understanding of the individuals and the different suppliers that are there.	RQ1, RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP				Derek found that the knowledge flowed freely between the organisations.											
Participant	If you were to attempt to bring along the senior managers of those organisations it would actually, it would slow it down. So you need to have a bit of fluidity in that working group.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP					It was Derek's view that senior managers from the Supplier Companies would slow down the knowledge flow. People who had a vested interest in the design of parts were usually at a junior level.									
Interviewer	Yeah, I was quite mindful of the fact that you said erm people who have actually got a vested interest in the design, well they tend to be more junior people who've actually imparted a bit of blood, sweat and tears into the design. Yeah.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP																
Interviewer	Erm what was it that the temperature sensor supplier was…what had you done in the past at the company…it was Company O1 in that instance, wasn't it, yeah?	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Yeah. So there were a couple of different suppliers involved. Erm so basically we designed a temperature sensor which is erm about 35cm long, and it goes to a sort of very, very thin point, okay. And erm it's basically just a resistance thermometer, okay.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP						The Supplier Companies involved in making the Temperature Sensor considered the various processes to make it. Honesty, Ability				The Temperature Sensor was originally designed by Company O1, which is like a long resistance thermometer that is 8mm dia x 35cm long. The Temperature Sensor was designed so it fits in a pocket located in the Reactor Plant. Given it's geometry and the way it fits neatly within the assembly could present issues when trying to assemble it.						
Participant	And that's got to fit into a pocket which has been erm deep drilled, the same 35cm, a diameter of about 8mm. Okay.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP																
Participant	So, the issue that had been there from the start was trying to…erm trying to drill that hole to the diameter and the coaxiality that you need, is very, very difficult. And we hadn't managed to give them any measurement and engaging that would allow them to get a numerical value on whether they've got coaxiality with the different steps in this hole, and so we just got to a stage where we say well what you do is you put one of those thermometers in and you sort of feel it, and if it feels okay then that will be all right. There was no more science kind of than that, and of course…and Company U, they'd assembled it and then they found that they…you know, they sort of dry assemble it, then they found they couldn't get the things out again.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP	Company O1 reflected on the Supplier Company's issue and realising that they provided a subjective method of dealing with the matter to the Supplier Company	7 Empathy, Judgement	Company O1 told the Supply Company to put one of the Sensors in and see if it *"felt ok"*. There was no exact science to test what *"felt ok"* meant.						The Suppler Companies realised that the responsibility of identifying the root cause lay with Company O1.	The Supplier Companies consider the different parts related to the Temperature Sensor (see above).	5 Honesty, Empathy, Ability	At the Consortium, one of the Supplier Companies recalled that that they explained to Company O1 that they found it difficult to drill a hole to the required dimensions realising that they would need some way to check the coaxiality at different points in the hole. Company U subsequently dry assembled the Reactor plant and found they could not get the Temperature Sensor out again. The Temperature Sensor had snarled up inside the Reactor Plant housing, which was the issue.		
		RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP																
Participant	So, it had absolutely snarled up inside and so that was the issue.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP																
Participant	The root cause was that we'd asked somebody to manufacture something that they had no way of validating the geometry of and we'd chosen to ignore that.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP		6 Honesty, Empathy Integrity	Company O1 had admitted that they asked the Supplier to manufacture something that they had no way of validating , which was the hole in which the Temperature Sensor fitted.													
Interviewer	Okay. So my instinct, if I was working with somebody who asked me to do that, and then that happened, the level of trust would have gone down. It's quite interesting that the supplier actually came around the table and actually talked to you. You obviously must have had plenty of erm history working together on previous projects for that trust to be there, yeah?	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Yeah. In that particular case that supplier really did need us, actually. They hadn't got that many other customers and they really wanted it to work.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP									The Supplier Company who manufactured the Reactor Plant Housing wanted to solve the issue as they didn't have many other customers.							
			RQ3D1, RQ3D1 TPK MAP																

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Table F10 Large Company Sub-Group Narrative Map for Relationship Conclusion Phase (Case Study Four)

	Response:	RQ No:	Map Filter	Behaviour (TA) (Large Co)	Action (Large Co):	Trust Antecedent (Large Co)	PKS (What/How) (Large Co):	Behavour (TD) (Other Co):	Trust Action (Other Co):	Trust Descendent (Other Co):	Outcome	Behaviour (TA) (Other Co)	Action (Other Co):	Trust Antecdent (Other Co)	PKS (What/How) (Other Co):	Behavour (TD) (Large Co):	Trust Action (Large Co):	Trust Descendent (Large Co)	Outcome
Interviewer	Like you mentioned a specific scenario where you had a consortium where you got a number of suppliers together. Erm this is question 12. Erm were the consortiums coordinated by Company O1 or Company U, because I think the issue was the number of suppliers that were working with Company U at the time, yeah.	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Hm? Erm…I don't actually know the answer to that question. It's most likely it would have been done by both Company U and Company O1.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP								The Supplier Consortium was arranged by both Company U and Company O1.								
Interviewer	Okay. And question 13, was it difficult to get agreement from senior people in supply companies to agree to get junior people to attend the supply consortium? Because you did actually say that there were some more junior people attended the…attended the consortium.	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Um. So the difficulty is sometimes that larger organisations are very cynical and untrusting about what this shared event or activity is. And if, erm you know, most engineers in Company O1, if somebody at Company U says oh we've got this problem, we need you to come along and help us out with it, most engineers would say yeah, that's no problem, we'll come along and we'll help you. But then the commercial part of those organisation would say hang on, we're not going to do anything that suggests that we're accepting liability, and if we're going to do this, if they want us, they'll have to pay for that time.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP									Company U had worked with Company O1 for along time and were happy to help Company U. Commercial staff of Company O1 were invariably unhappy about their engineers doing this.	Company U engineers recognise that if they have a problem they can approach Company O1 for help.	1 Honesty, Ability	Company U asked for help with their problem from Company O1	Company O1 engineers are happy to help Company U with their problem.	Company O1 go over to Company U to hep them define the problem and formulate potential solutions.	Empathy, Benevolence	
		RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP		Company O1 identified a problem with one of its product assemblies. Derek refers to one assembly issue with a Temperature Sensor.	2 Honesty, Ability	Company O1 would invariable ask the respective Supplier companies (small and Large) to attend a Consortium event to discuss their problem. Agenda items may be circulated in advance.	Most large organisations are usually very cynical and untrusting about events like the Supplier Consortiums.	The Commercial part of supplier companies would see the attendence of a Supplier Consortium as accepting liability and would not be keen attending. They would also suggest that if they were going to be involved then Company O1 or U would have to pay for it.	Confidence (Low), Integrity (Low)								
Participant	So that's what tends to slow things up. You have the engineers who are very happy to get involved and do things, but of course somebody has to pay their wages and they don't always think through where that's going to come from. And then there can be very damaging political motivations where maybe Company O1 and Company U are bidding on a particular contract and they're going head to head and for various reasons Company O1 decides it does not want Company U to have a success and doesn't want them to be shown in a good light, and that happens as well.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP	There can be damaging political motivations where both Company O1 and Company U are bidding on the same contract and therefore Company O1 may not want Company U to be shown in a good light.														Progress on arranging supplier consortiums can get slowed down, while engineers are quite happy to get involved they often don't think about who is going to pay their wages.
Interviewer	Okay. So in most circumstances you manage to get senior people on board to get the agreement for junior people to attend, yeah?	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Yeah. Yeah.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP								In most circumstances Senior Management come on board and let junior personnel take part in activities such as Supplier Consortiums.								
Participant	But the erm…I would say generally in my experience erm the size of the company is inversely proportionate to the level of trust. So you…with the smaller companies you are generally speaking to quite senior people and you know that they won't let you down. If they commit to something they won't let you down. In the larger organisations, even though you think you've got commitment they'll then come back and say oh some other department has done something that means it's not that straight forward. So establishing and confirming trust in these sorts of consortiums can be quite difficult.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP								Company Size is inversely proportional to the level of trust. In Derek's experience, Smaller companies, have not let Derek down. Larger companies hesitate to get involved.								
Interviewer	That brings me on nicely to the fourteenth question which relates to coaxiality issues that you identified. I'm assuming that them actual issues were identified at the consortium itself, is that right?	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	Yeah, that's right. And so Company O1 shipped the product believing it was good. Company U assembled the product believing it was good, and then on testing they found a fault and then when they tried to get the product out it wouldn't come out because it was all jammed.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP		Company O1 shipped the Temperature Sensor believing it was good.	3 Ability, Reliability	Company O1 requested that Company U assemble the Temperature Sensor to specification.		Company U assembled the product believing it was of an acceptable quality, and then tested the product.	Empathy, Judgment	Company U found a fault and then when they tried to get the Temperature Sensor out it wouldn't come out because it was jammed in the housing.							
		RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP								At this point both Company U and O1 arranged a Supplier Consortium to look at the Temperature Sensor issue.								
Interviewer	Right yeah. Erm so by people actually discussing what everybody does, basically their role in the erm in the process of making it, then this, by thinking it through aloud, as it were, then there were actually…you referred to the temperature probe, the geometry of it and I think it's cut to only around about three [mm], it's about like a thermometer isn't it, and it fits in a very narrow pocket.	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Interviewer	And it was getting snagged up, as it were.	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Interviewer	Was the issue itself resolved? At the consortium itself was a solution arrives at by various people at the consortium itself, or was it just did you just actually say well okay, we found the issue now erm and we agree to erm take corrective actions, a certain list of corrective actions, at the consortium and then you actually went away and then just implemented the corrective actions. Is that how it went?	RQ3D1, RQ3D1 TPK (For Ref)	RQ3D1, RQ3D1 TPK MAP (For Ref)																
Participant	So the solution was not erm provided by the consortium. And the reason for that was that no individual member of the consortium had the overall end-to-end view of the process. So in Company O1 we collected together the end-to-end view of the process. We highlighted what the improvement opportunity was and then got agreement from the consortium to enact that solution.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP		After the Consortium took place, Company O1 collected together the end-to-end view of the process from all supplier companies.	8 Empathy, Judgement, Integrity	Company O1 then highlighted what the improvement opportunities were to each member of the Consortium. Note: The solution was not provided at the consortium. No individual member of the consortium had the overall end-to-end view of the process.	Consortium members were happy to provide some input for Company O1.	Each Supplier company considered the improvement opportunity and provided feedback based on their experience.	Empathy, Judgment	Company O1 obtained agreement from the consortium to enact the solution.							
Participant	Yes. Because the liability for the issue erm from the outset was Company O1's. So it was within Company O1's interest to come up with a solution.	RQ3D1, RQ3D1 TPK	RQ3D1, RQ3D1 TPK MAP	The liability for the issue from the outset was with Company O1. It was in Company O1's interest to come up with a solution.															
			RQ3D1, RQ3D1 TPK MAP																

KEY:
Green Text: Trust Antecedents and Trust Descendents

Blue Box: Explicit Practice
Blue Test: Tacit Practice

Red Box: Explicit Procedural Knowledge
Red Text: Tacit Procedural Knowledge

TA: Trust Antecedent
TD: Trust Descendent

Table F11 Large Company Sub-Group Narrative Map for Relationship Conclusion Phase (Case Study Four) (Follow Up)